

**Through the Lens of the Toyota Production System:  
Recommendation for the Implementation of a Regional  
Anesthesia and Surgical Network in Michigan's Upper  
Peninsula Critical Access Hospitals Owned by Aspirus, Inc.**

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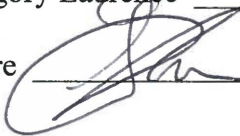
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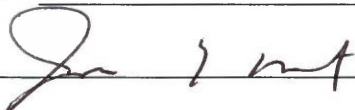
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### Abstract

**Purpose:** This Capstone project sought to determine if a Regional Anesthesia and Surgical Network (RASN) was an appropriate program for Aspirus to implement in Michigan's Upper Peninsula (UP) Critical Access Hospitals (CAHs) using lean methodology learned from the Toyota Production System (TPS). RASN's areas of influence include anesthesia and surgical personnel management, standardization, workflow optimization, fiscal management and monitoring, supply chain management, quality improvement, brand imaging, and efficiency. RASN would merge the anesthesia and surgical departments into one lean practice, utilizing data and evidence-based literature to guide operational, financial, and clinical services and decisions.

**Methods:** Data was gathered from key contacts at three out of four UP hospitals owned by Aspirus, Inc. Items examined included anesthesia staffing models, surgical department statistics, and available Enuff Budget and Variance reports. An exhaustive literature review was completed.

**Results:** As identified in literature, numerous hospital systems have experienced positive outcomes with system level management, standardization, and lean implementation. Combining evidence-based literature with the author's personal experience at Aspirus CAHs, the author drew a professional recommendation in favor of implementing RASN using lean methodology throughout the CAHs. RASN provides Executive-level leadership and department managers with the necessary infrastructure to operate high performing surgical and anesthesia departments, offering a clear competitive advantage in the UP. A Regional Director of Anesthesia and Surgical Service Lines must lead RASN, developing the vision across the Aspirus system. With RASN, Aspirus may experience over \$4 million in savings throughout the four UP hospitals.

**Conclusion:** The author's expert opinion encourages Aspirus to pursue RASN, applying TPS to the anesthesia and surgical departments. RASN provides an opportunity to maximize value for the organization, while decreasing waste and increasing customer and staff satisfaction. Most importantly, the Aspirus surgical experience would become branded throughout the UP, providing the same experience for patients at each Aspirus surgical department. Final recommendations were compiled into a booklet for dissemination to Executive-level leadership.

**Data Sources:** PubMed, CINAHL, Google Search

**Keywords:** Anesthesia, Surgery, Network, Lean Methodology, Toyota Production System, Critical Access Hospitals, Aspirus, Waste



## **Introduction**

The Chief Operating Officer (COO) of Aspirus Grand View (AGV) Hospital envisioned the idea of a Regional Anesthesia Director. The Director would oversee standardization and streamlining of the anesthesia departments at critical access hospitals (CAHs) owned by Aspirus, Inc. in Michigan's Upper Peninsula (UP). During data examination, the author expanded the COO's vision for the Director to not only manage anesthesia, but also the surgical departments. Change in one without the other is impossible. The author's proposed program, the Regional Anesthesia and Surgical Network (RASN), joins the CAHs into a unified network where waste and excess capacities are decreased, and utilization of resources is increased. RASN applies the Toyota Production System (TPS) and expert recommendations to maximize value for Aspirus.

The research question under investigation in this Capstone project can be stated as: is RASN an appropriate program for Aspirus to implement in Michigan CAHs using lean concepts learned from TPS? This question was explored throughout the Capstone project. The author's final recommendation to implement RASN is the result of critical analysis from available reports, as well as applied knowledge gained through personal experience and education, revealing the validity of implementing the Network throughout the UP.

## **The Concept of RASN**

The concept of RASN is a visionary program designed to decrease hospital subsidization of monies and resources to the anesthesia and surgical departments, and most importantly, provide the UP communities with high-quality, uninterrupted, specialty services. The Network would merge the four anesthesia and surgical departments into one lean practice, utilizing data and evidence-based literature to guide its operational, financial, and clinical services and

decisions. RASN's goals include resource and supply chain management, and brand imaging for Aspirus' surgical services. To accomplish the objectives, the Director's responsibilities utilize lean methodology to decrease waste and increase efficiency, ultimately achieving growth within Aspirus.

#### *Regional Director of Anesthesia and Surgical Services Lines*

Strategic management of RASN is the Director's main responsibility, taking the vision and bringing it to fruition. RASN is best managed by a Regional Director of Anesthesia and Surgical Services Lines with expertise in those areas, as well as lean, financial, and business administration experience. The Director will embrace collaboration and teamwork by working closely with surgeons, managers, anesthesia providers, administrators, surgical department staff, financial analysts, and information technologists to build relationships. It is imperative for the Director to demonstrate a lifelong compassion for people, especially patients and families.

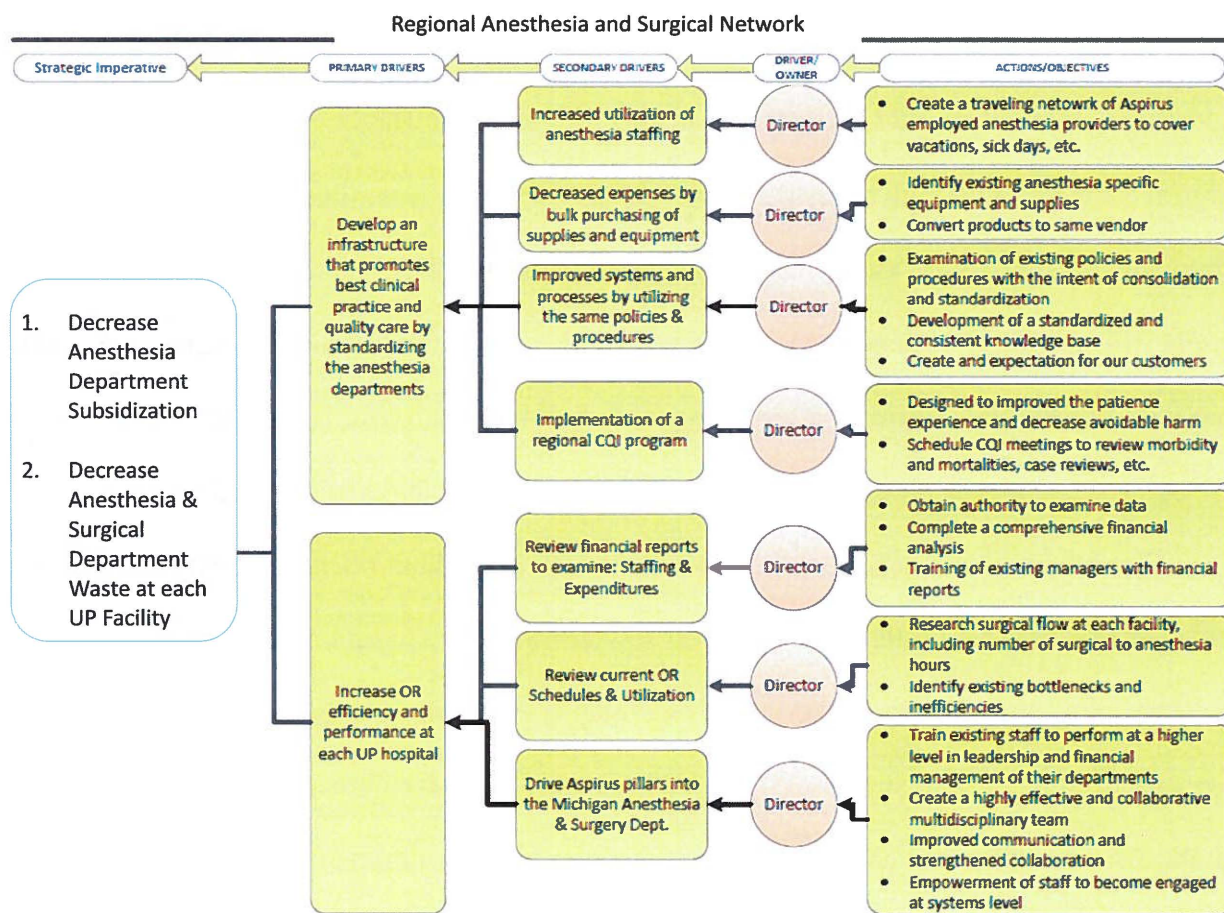
The Director's commitment for Aspirus' growth throughout Michigan drives him/her to oversee the success of anesthesia and surgical services within the rural UP. This passion is necessary to expand practices and promote high-quality care, branding a surgical experience at an Aspirus facility. Possessing a self-directed leadership style, the Director will foster a culture valuing Aspirus' mission, vision, and values. The job description found in Appendix A, is a detailed example of the required qualifications and responsibilities for such a position.

#### RASN's Driver Diagram

Driver diagrams are utilized by Executive-level management at Aspirus, Inc. to achieve high-level strategy. The author used this tool to diagram RASN into an understandable program for successful implementation (Figure 1). The strategic imperatives of RASN are to decrease

hospital subsidization to the anesthesia department, and eliminate anesthesia and surgical waste at each UP facility. The first primary driver is developing an infrastructure, promoting best clinical practice and high-quality care through standardization. The second primary driver is increasing surgical efficiency and performance.

Figure 1



Each primary driver has secondary drivers. The secondary drivers associated with the first primary driver include a.) increased utilization of anesthesia staffing, b.) decreased expenses with bulk purchasing of supplies and equipment, c.) standardization of policies and procedures, and d.) implementation of a regional anesthesia quality improvement (QI) program. The secondary drivers supporting the second primary driver are as follows: a.) review of financial reports, understanding staffing and expenditures, b.) review current operating room (OR)



schedules and utilization, and c.) support of the Aspirus pillars in each department. Figure 2 summarizes all areas of RASN's influence within the secondary drivers.

**Figure 2**



A more detailed description of RASN, explaining additional actions and objectives of each sphere of influence identified in Figure 2, is listed below:

1. Developing an infrastructure, promoting best clinical practice and high-quality care:
  - a. Increased utilization of anesthesia staffing:
    - Build a highly collaborative team consisting of surgeons, anesthesia providers, surgical staff, managers, administrators, and related



departments such as purchasing, pharmacy, and management information/information technology areas

- Increase employee engagement and buy-in
- Provide a low-cost solution to the need for anesthesia coverage by sharing anesthesia providers among the CAHs without the high costs associated with the utilization of locum staff

b. Supply chain management:

- Identify distributor and costs of existing equipment and supplies
- Convert products to the same vendors for bulk purchases
- Share supplies among facilities through RASN

c. Standardization of processes, policies, and procedures:

- Examine existing policies and procedures with the intent to consolidate and standardize
- Development of consistent knowledge base
- Create an expectation for Aspirus customers
- Brand Imaging / Growth Volume / Market Share Capture
  - Brand the Aspirus surgical experience with standardization of processes and customer services
  - Improve patient satisfaction scores
  - Expect and accommodate surgical volume growth and specialty expansion
  - Recruit and retain talented surgical and anesthesia staff, including surgeons

d. Quality improvement (QI):

- Support of best clinical practices with a regional anesthesia QI program
- Maintain high-quality care and continual service improvement
- Research for evidence-based practices
- Implement cutting-edge processes

2. Increase OR efficiency and performance at each UP hospital:

a. Fiscal management and monitoring:

- Financial improvement through waste reduction and improved efficiency of surgical department resources
  - Strengthen the OR and anesthesia contribution margin and revenues
  - Knowledgeable Director trained in financial and business administration
- b. Workflow optimization and time management with lean application:
- Reduce variations in surgical volumes by modifying existing block schedules
  - Eliminate waste and decrease rework of perioperative processes through standardization and streamlining steps
  - Minimize surgical bottlenecks with steady flow of work
- c. Drive Aspirus pillars into the UP anesthesia and surgical departments

#### Aspirus Pillar Linkage

“One Future, One Focus” is an Aspirus initiative which seeks to unite the separate entities under one goal: “To build a patient focused, physician-partnered system that provides the highest quality care to the communities we serve in a cost effective manner”.<sup>1</sup> RASN aligns its strategic imperative with the “One Future, One Focus” initiative, bringing support from the five Aspirus pillars into the UP’s anesthesia and surgical departments (Figure 3).

- *Financial Performance*: recognize and reduce waste with lean application to increase revenue, enhance profits, and experience fewer losses
- *People* (including providers, staff, and administrators): engage staff at a system’s level; a sense of belonging to something greater; train staff to perform at a higher level in leadership and financial management; create a highly effective multidisciplinary team; improve communication and strengthen collaboration
- *Growth*: attract and retain highly-skilled providers; recapture patients who left the Aspirus system for other competitors through brand imaging

- *Quality*: improve upon the infrastructure of evidence-based policies and procedures; standardize to streamline processes
- *Service*: brand the “surgical experience” at an Aspirus facility; recover market share by exemplary customer service standards; creating an expectation of “Aspirus”

**Figure 3**

The author’s decision to support the vision of RASN was solidified through extensive literature review, including the application of lean methodology in healthcare and surgery. Overwhelming consensus from expert research acknowledges an evolving healthcare industry and the need to change. Strategies used within the TPS can aid and sustain this transition for



Aspirus' anesthesia and surgical departments. The following literature review supports the vision and drivers embedded within RASN's concept.

## **Review of Literature**

### The Healthcare Industry

Transformation in healthcare is more critical now than ever before.<sup>2</sup> Changing reimbursement, the current economic climate, rising expenses, and aging Baby Boomers, have created challenges for the industry. Today's hospitals are forced to integrate and become more accountable as a result of reduced reimbursement and slow economic recovery.<sup>3,4</sup> Consolidations, mergers, and long-term partnerships occur as individual hospitals seek support to operate under healthcare reform, an unsustainable payment system, and an evolving industry.<sup>3</sup>

Experts believe the number of mergers, acquisitions, and partnerships will continue to increase.<sup>3</sup> Effective healthcare delivery requires a team approach to deliver safe, high-quality services, while lowering costs, waste, and inefficiencies.<sup>3,4</sup> Relationships are critical for coordinating patient care across hospital systems, as the importance of communication among facilities reaches an all time high.<sup>3</sup> Other major influences, such as the demand for reporting outcomes, the push for transparency, improved patient satisfaction, increased quality improvement, and flawless safety standards raise the need for collaboration among hospitals.

The Healthcare Financial Management Association (HFMA) identified four key areas to financial success for hospitals.<sup>5</sup> First, a hospital should effectively manage its service lines. Each service line should be well-defined and standardized. Second, hospitals must consider employing physicians and staff, especially those in high-demand specialties who face industry shortages.

Third, an open collaborative environment must exist between clinicians, finance departments, vendors, and payers to examine financial performance and discuss areas for improvement. Finally, hospitals should encourage staff to create mechanisms for improved efficiency and cost reduction.<sup>5</sup>

### Anesthesia Departments

#### *Anesthesia Providers*

Currently, 40,000 anesthesiologists and 36,000 Certified Registered Nurse Anesthetists (CRNAs or nurse anesthetists) administer anesthesia in the United States.<sup>6</sup> Anesthesiologists are physicians who have completed medical school, a clinical-based residency, and a three year residency within an anesthesia program. Graduating from a master's or doctoral-level nurse anesthesia school, CRNAs are advanced-practice nurses who possess high-acuity patient experience and pass a national certification examination.<sup>6</sup>

Nurse Anesthetists may practice under a variety of delivery models.<sup>6</sup> Those who provide anesthesia services for a patient under an operating practitioner, not an anesthesiologist, are referred to as *non-medically directed* or *independent*. CRNAs who work under an anesthesiologist are *medically directed* or *supervised*. Both types can perform the same anesthesia services, including difficult and relatively rare procedures.<sup>6</sup> Anesthesiologists and CRNAs are equally important in the delivery of safe, high-quality anesthesia care, regardless of the practice model.<sup>6,7</sup>

More than 50 percent of American hospitals, including those in the state of Michigan, suffer from a shortage of CRNAs and anesthesiologists.<sup>8</sup> In Michigan, there are six anesthesiologists for every ten CRNAs.<sup>7</sup> CRNAs are the sole providers of anesthesia for 65

percent of rural hospitals. Approximately 8.4 percent of anesthesiologists reside in rural areas compared to 18.6 percent of CRNAs.<sup>9</sup> Either provider can be substituted for the other, as they share similar roles. In rural areas, the substitutability is critical when filling open positions.<sup>9</sup>

#### *Locum Tenens Anesthesia Providers*

Locum tenens (locum) anesthesia providers are those who temporarily fill a position when needed for a permanent staff member. If locum tenens are employed, costs can be rise above those of permanent staff, due to additional benefits such as meals, housing, airfare, ground transportation, and malpractice coverage.<sup>10</sup> Agency fees of an additional 17-18 percent usually apply to cover expenses for recruiting, credentialing, insuring, and coordinating locum schedules. Charges per contracted service can vary, and do not include benefits.

Anesthesiologists generally cost over 50 percent more than CRNAs.<sup>10</sup> Locum tenens anesthesia services are often purchased by hospitals during permanent employees' time off.

#### *Anesthesia Department Services*

Anesthesia providers may be called to locations other than the OR, such as Obstetrics, Emergency, Radiology, and the Intensive Care Unit.<sup>11</sup> As well-positioned leaders within a hospital, anesthesia providers can serve as managers of perioperative efficiency.<sup>12</sup> For example, when not providing hands-on patient care, anesthesia providers support colleagues with OR turnovers and assist with scheduling concerns. Both Anesthesiologists and CRNAs are educated to facilitate safe and efficient throughput of patients, as well as improve the coordination of care and communication across departments.<sup>12</sup> Additionally, anesthesia providers can contribute to waste reduction and surgical department growth through insightful participation in decisions regarding block schedule allocations, department finances, capital purchases, staffing, and development of clinical pathways.<sup>12</sup> The overall goal of the department should be to deliver

high-quality anesthesia care to patients, while decreasing the general cost of the services.<sup>7</sup>

Organizational and operational influences are likely to have the largest impact on anesthesia department costs.<sup>13</sup>

#### *Anesthesia Department Comparison*

When examining productivity and operational effectiveness, it is often useful to benchmark performance, comparing the department with other teams.<sup>14,15</sup> Benchmarking and past performance can be useful to set productivity goals. However, the performance of anesthesia departments can be difficult to benchmark, especially when clinical productivity is examined.<sup>16,17</sup> This is due to differences in staffing ratios, the number of anesthetizing locations to be staffed, variances in revenue generation from the populations' payer mix, and organizational factors, such as the number of operating rooms and type of hospital.<sup>16</sup> Other factors to consider are call demands, individual preferences, employment contracts, and applicable staffing costs.<sup>18</sup> It is imperative to compare anesthesia services at hospitals with similar positions.<sup>14</sup>

#### *Anesthesia Department Expenses*

Managers should consider both direct and indirect influences upon an anesthesia department's budget.<sup>19</sup> Staff salaries, clinical supplies, medications, anesthesia equipment, and maintenance and service contracts are examples of those influences. Non-labor related anesthesia costs can constitute over 10 percent of the anesthesia department's profit-and-loss statement.<sup>12</sup> Issues within the department often addressed due to budget variances range from reduction of extra anesthesia providers, increased control over the OR schedule, improved overhead management, negotiation of better managed care contracts, and adoption of team approaches.<sup>19</sup> The most important underlying factor for controlling anesthesia department costs remains in the orchestrated improvement of OR utilization.<sup>19,20</sup>



### The Surgical Department

Surgery is a high priority department within a hospital.<sup>21</sup> It is well-known as the most profitable but most costly, resource-intensive area within operations, generally capturing the facility's largest capital and operational budgets.<sup>21-25</sup> As a significant contributor to the financial status of a hospital, surgery produces 60 to 70 percent of a facility's net revenues.<sup>22,23</sup> Due to its important position, the possibility of other departments and programs often depend on the success of the OR.<sup>22</sup> Therefore, a hospital's economic viability demands maximum OR efficiency by responsible and financially knowledgeable managers.<sup>21,24,25</sup>

### *Surgical Department Inefficiencies*

Surgical department inefficiencies are caused by many factors, including poorly followed processes.<sup>21,26-29</sup> Sources include human resource mismanagement, infrastructure breakdown, scheduling variations, technology issues, process flow problems, and information management concerns.<sup>29</sup> The unpredictability of surgical and patient events is perhaps the greatest challenge resisting OR efficiency.<sup>21</sup> Staff and patient satisfaction, safety, and patient outcomes must be considered with efforts to increase OR productivity and efficiency.

### *The Difficulty of Surgical Management*

The requirements placed on surgical department managers are greater in today's healthcare environment than ever before.<sup>25</sup> Demands for flawless patient safety records and quality, as well as dynamic alterations to reimbursement and standards of care, require a surgical department manager to understand and adopt new processes on a continual basis.<sup>22</sup> Leaders are required to be skilled transformational change agents, capable of growing a culture that quickly adjusts to regulatory, market, and professional adjustments and advancements.<sup>22</sup> Gradual, incremental improvements within the department are no longer adequate; the ability to lead



transformational change, which meets or exceeds industry standards, is paramount. Overall, effective surgical leaders must be big-picture thinkers with a clear understanding about issues affecting OR performance, and the strategic objectives of a successful surgical department.<sup>22</sup>

Experienced perioperative nurses, who often run surgical departments, possess a strong understanding of surgery, and the supplies and equipment required to perform the procedures.<sup>24</sup> Yet, current literature clearly suggests surgical knowledge is not enough to manage an efficient OR.<sup>22</sup> Managers are asked to have superior clinical skills, and an intense understanding of business, statistics, and financial management.<sup>24,25</sup> Today, leading a surgical department should be more like managing a business, when considering the juggling of funds, assets, and resources to maximize profit.<sup>22</sup>

Simply possessing the skills to organize staff schedules and facilitate new employee orientation are no longer the standards for surgical nurse leaders.<sup>24</sup> One must justify departmental expenditures, demonstrate cost savings, calculate full-time equivalents, predict staffing needs, and plan for growth with new services.<sup>25</sup> Business and financial skill deficiencies exist for most surgical department managers, despite their responsibility for one of the most critical clinical areas within a hospital.<sup>24</sup> Generally, lack of formal training in business is to blame, as nursing school does not teach skills in finance and strategic planning. Instead of learning how to manage the department correctly, surgical managers spend their days responding to small catastrophes without ever addressing the greater, overall problems.<sup>22,24</sup> This reactive form of leadership supports unrealistic surgical managers who perceive their ORs as running well, despite obvious signs of trouble observed by outsiders.<sup>22</sup> Adequate instruction can assist with daily management of the department and improve the working knowledge of financial and materials management.<sup>24</sup>

Concepts addressed with education should include budgets, standardization, procurement, and value analysis.<sup>24</sup>

Surgery cancellations and limited supplies and equipment challenge surgical department management.<sup>23</sup> The greatest contributing factor is recognized as scheduling-related problems. Delayed first-start cases caused by patient issues, tardy room setups, unavailable equipment or supplies, and tardy personnel, can cause the day's schedule to lag.<sup>23</sup> Additionally, variations in patient volume lead to difficulties in controlling patient flow, resulting in underutilized ORs. Maximizing the use of staff, rooms, and equipment, through effective scheduling is critical to optimizing OR efficiency.<sup>23</sup>

#### The Surgical Block Schedule

The surgical block schedule is the most critical component of an OR.<sup>30</sup> It allows leaders to coordinate resources and patient care, ensuring optimal use of surgeons, staff, anesthesia providers, rooms, and equipment. An inefficient system increases department costs by wasting resources and creating general dissatisfaction. The end result may drive away patients and talented staff. Symptoms caused by inefficient schedules include:<sup>30</sup>

- Consistent late starts for procedures caused by surgeon delays
- Consistent late starts for procedures caused by anesthesia delays
- Consistent late starts for procedures caused by nursing delays
- Continual case juggling requiring crisis management from staff
- Suboptimal operating room use with gaps between procedures
- Extended perioperative and postoperative stays secondary to patient flow problems and unavailability of staff
- Excessive overtime for surgical staff
- Low surgical staff morale

- Bottlenecks due to mismanaged patient volumes
- Distrust in an ineffective surgical schedule

Theoretically, a surgical schedule allows elective procedures to start as planned, yet provides flexibility for urgent and emergent cases.<sup>23,30</sup> Studies have proven optimal surgical scheduling increases surgeon productivity and revenue, decreases the cost per surgical procedure, uses the facility more efficiently, and improves nursing and anesthesia productivity and morale.<sup>30</sup> If resources, such as staff, equipment, and ORs are maximized, staff can efficiently plan their time.<sup>23</sup> Within one year of implementing a strict block schedule, Wingerter and Ackerman reported an increase from 52 to 75 percent in room utilization, and a 27 percent reduction in overtime.<sup>31</sup> Cancellation rates decreased while add-on cases dropped to 9 percent, below the national average of 12 to 15 percent. An additional benefit was the normalization of variations in daily patient volume.<sup>31</sup>

A balanced surgical schedule demands flexibility from each stakeholder.<sup>30</sup> Needs of surgeons, anesthesia providers, nursing, surgical staff, managers, and administrators, should be identified. Members of the surgical team may bring personal or political agendas into a schedule discussion.<sup>30</sup> Some individuals may falsely believe the surgical schedule is functioning well. Others focus on the symptoms of ineffective processes rather than real issues. To overcome these barriers, it is imperative to capture surgeon and staff support with convenient scheduling, quick accommodation of add-on cases, prompt on-time starts, timely turnovers, and continuous improvement of staff proficiency and skill-sets.<sup>30</sup> Changes are ideally communicated to surgeons and staff at least one to three months in advance.<sup>23</sup>

When developing the surgical schedule, stakeholders should examine historical demand of the ORs, including elective and emergent case patterns.<sup>23,30</sup> Surgeons with the highest financial contribution margins per hour have initial choice of block times.<sup>30</sup> Less productive

surgeons fill the remaining availability. This results in varied block time per surgeon, based on the day of the week or length of the block.<sup>23</sup>

The schedule can be monitored and adjusted based on recent performance and surgeon compliance.<sup>30</sup> Review of the new surgical schedule ideally occurs every three to six months. A report should be created to show the percentages of block times used, amount of block time surrendered due to surgeon time off, and number of surgeries performed outside of scheduled block time.<sup>30</sup> This report will help determine if block use is on target and if block times are correctly sized. For example, if there is a large amount of surrender time, that particular surgeon may have excess scheduled block time. Likewise, if a surgeon is performing a large amount of surgeries outside his/her block time, more availability should be assigned to that surgeon.<sup>30</sup>

Strict rules for scheduling elective, urgent, and emergent cases are developed based on each surgeon's financial contribution, percentage of existing block time used, number of surgeries performed in the past, compliance with hospital regulations and policies, and commitment to the growth of the hospital.<sup>23</sup> These rules must be clearly addressed in written OR policies.<sup>30</sup> Compliance from stakeholders requires regular monitoring from management. Enforcing change also requires a strong physician leader who imposes consequences when the scheduling rules are not followed. Penalties start with a verbal warning, but lead to the loss of block time for a specific period. Without a detailed plan to maintain surgical schedule compliance, the number of sustainable changes will be limited.<sup>30</sup>

#### *The Surgical Block Schedule and the Anesthesia Department*

Although vital to a successful surgical suite, anesthesia is often under scrutiny.<sup>7</sup> The amount of anesthesia provider compensation and the number of staff assigned to cover a facility can directly affect a hospital's subsidization of the anesthesia department.<sup>12,32</sup> If overpaid and



overstaffed, the hospital is forced to provide unnecessary subsidization to the inefficient, underutilized anesthesia department.<sup>7,11,12,33</sup> Academic hospitals within the United States pay an average of \$95,000 per anesthesiologist in additional compensation for inefficient management decisions.<sup>34</sup> Literature has shown institutional subsidization can be reduced by minimizing the inefficiency of OR scheduling.<sup>31,35,36</sup> Poor control over the OR schedule creates an extra expense, forcing cases to be stacked, without planned interruptions between surgeries, and mandates overtime for surgical staff.<sup>37,38</sup>

If OR times are not scheduled to maximum efficiency, anesthesia departments are burdened with excess labor costs.<sup>37</sup> For example, an excess of \$1.1 to \$2.0 million in annual compensation was paid to both academic and private-practice anesthesia providers at two hospitals examined in the literature.<sup>37</sup> Researchers determined the facilities followed inefficient surgical case scheduling and allocation of OR times.<sup>37</sup>

Cases should be carefully scheduled with regards to efficient use of anesthesiologists and anesthetists.<sup>39</sup> Allowing for an elective case to be added on at the end of the day is not acceptable if other blocked days for that physician remain open. The pendulum of accepting overutilization of anesthesia staff one day and underutilization the next is a poor model of anesthesia staffing and can significantly impact a hospital's bottom line.<sup>39</sup> One solution is to allow the anesthesia group full control over the block scheduling.<sup>32</sup>

When surgeries are performed after regularly scheduled hours, overutilization of the operating room occurs.<sup>37</sup> It is recommended that cases are not added after hours unless the surgeon's allocated time is full or there is a medical necessity for the surgery.<sup>32,40,41</sup> Cases freely added during overutilized time should be reviewed by a surgical services committee when questioned by affected staff members, such as a surgeon, anesthesiologist, nurse anesthetist, or

nurse.<sup>41</sup> Similarly, underutilization occurs when surgeries and room turnover are not performed during regular department hours. Ideally, anesthesia staffing can be planned for routine procedures with the understanding that a surgeon's allocated time is filled first, before another case is added to the schedule at a different time or day.<sup>39</sup> If add-ons do occur, it is important to immediately release another service's underutilized allocated anesthesia time. This is usually done within a two week time block and prevents overutilization of anesthesia providers.<sup>39</sup>

Hospital and anesthesia management should continually and collaboratively analyze key metrics to evaluate OR utilization.<sup>24</sup> Leaders should focus on the two key operational risks of ORs, underutilized or high idle OR time, and overutilized or overtime hours. Directly affecting the bottom line, the solutions to solving these problems may include the closure of OR suites on certain days or at specific times to ensure anesthesia labor efficiently aligns with surgical volumes.<sup>24</sup> Another option would be to increase the number of surgery starts at the beginning of the day, potentially decreasing delays or the underutilization of staff when surgeons must wait for an open OR.<sup>38</sup> If overtime at the end of the day is the main concern, management should consider opening more ORs for rotating specialties between rooms to increase the speed of room turnovers.<sup>38</sup>

### Toyota Production System (TPS)

In 1988, the term *Lean* production was coined from TPS to explain why Toyota Motor Company was more successful than other Western car manufacturing companies.<sup>42</sup> With consistent lean concepts, Toyota built a solid reputation for excellence.<sup>43</sup> This strategic competitive advantage gave Toyota untouchable reliability, quality, cost reduction, productivity, sales, and market share.<sup>44</sup> Checklists and documents were created to carefully guide daily

activities.<sup>43</sup> Employees were given responsibility for checking the quality of car parts within every stage of the process to provide the customer with unparalleled superiority compared to any other car manufacturer. Problems were identified quickly through root cause analysis, solved, and prevented from reoccurring again.<sup>43,44</sup>

Toyota became obsessed with organization and cleanliness.<sup>43</sup> This strict structure confirmed its importance when Toyota experienced improved staff performance, and an 18 percent productivity gain as employees no longer had to search for equipment, tools, and paperwork.<sup>43</sup> Using these methods, Toyota was able to reduce costs, and improve efficiency and quality compared to competitors. An unexpected result was that the company created a solid workforce of dedicated employees, full of pride, and possessing a strong sense of ownership.<sup>43</sup>

Lean thinking uses the scientific method to solve problems.<sup>45</sup> Developed as QI methodology, TPS shaped lean as a concept of continual improvement, focused on mapping out and maintaining processes which create value, and eliminated causes of waste and repetitive steps.<sup>46</sup> In TPS, lean means accomplishing more objectives with fewer resources.<sup>43</sup> With lean application, human effort, time, equipment, and space decrease. Yet, customers' needs remain fulfilled. There are many areas of focus within TPS, including:<sup>46</sup>

- Decreasing waste (also known as the Japanese word, *muda*)
- Forming processes and daily work flows around customer demands
- Standardizing
- Reducing repetitiveness and extra work
- Eliminating bottlenecks
- Decreasing lead, wait, and process times

The *learning line* is a central concept of TPS.<sup>47</sup> The learning line provides employees with an environment to gain knowledge about creating, operating, and improving work areas.

Lean upholds a strong belief that the people who do the work should be the ones to develop and advance work flow.<sup>47</sup> A key point within the learning line is to have staff solve only one problem at a time. In TPS, the learning line supports products which are delivered:<sup>16,44,47</sup>

1. On demand
2. Defect-free
3. One by one
4. Immediately
5. Without waste or error
6. In a physically, emotionally, and professionally safe environment

The six aforementioned critical attributes allow an organization to use systematic testing when attempting to optimize improvements.<sup>16</sup> During the design and testing of a potential solution, if an action does not meet any one of those characteristics, a countermeasure is created to decrease the impact on the customer.<sup>16</sup> For example, if a product cannot be manufactured quickly enough to meet demand, extra product may be stored as inventory in an effort to meet the customers' needs.<sup>16</sup>

#### *Work Organization within TPS*

Treville and Antonakis explored work organization within lean manufacturing companies.<sup>48</sup> Hierarchical structures were flattened and staff participated in decision making. Firms experienced increased employee skill variety and task identity, allowing workers to be cross trained and multitask more easily.<sup>48</sup> Lean managers provided routine feedback with tools used to describe information in a visually appealing manner.<sup>48</sup>

A key principle of TPS is respect for people.<sup>17,49</sup> TPS emphasizes providing all employees with opportunities for success.<sup>47</sup> *Kaizen*, a fundamental tool of lean methodology, explains how involvement of everyone in the organization is crucial for significant waste



reduction.<sup>49</sup> This work should be valued by providing a safe environment where staff grow and develop as individuals.<sup>45,47,50</sup>

Lean managers are expected to visit the location where employees actually accomplish work, known as the *gemba*, to prevent decisions based on inaccurate assumptions.<sup>45</sup> Daily, they coach and mentor staff to find and solve problems, to reach goals, and drive improvements.<sup>45,50</sup> Providing a supportive environment where staff openly discuss ideas and bring attention to problems, without blame, is one of the initial steps in lean implementation.<sup>45</sup> TPS methodology encourages asking why questions to understand frontline employees' issues, then supports the workers' solutions. This requires openness and transparency from leadership.<sup>45</sup>

## **Theoretical Model**

### TPS and Healthcare

Originally, experts believed TPS was only applicable to the manufacturing industry.<sup>45</sup> TPS has now proven its worth in other industries, especially healthcare.<sup>17,45,49,51-55</sup> Elevated demands for high-quality, efficient medical services, at lower costs, drove lean into healthcare.<sup>44,45,56</sup> A healthcare system may implement lean for other reasons, including the opportunity to improve customer-focus and efficiency, while strategically positioning the organization to battle tighter margins and dynamic market conditions.<sup>43</sup>

TPS changed the culture of many successful healthcare systems to CI, flow orientation, and teamwork.<sup>17</sup> This allowed staff to directly visualize how their contributions impacted work flow. A culture developed from an organization of staff empowerment and support of worker initiated improvements, is imperative. Lean culture encourages employees to continuously

develop new ways of providing better care for patients, not simply care for patients.<sup>57</sup> With lean application, Drotz and Poksinska discovered how teamwork and flow orientation in a hospital lead to greater understanding and appreciation of other professionals' roles and responsibilities throughout the work force.<sup>17</sup> When applied to daily work, accepted by employees, and supported by management, lean thinking can be sustained.<sup>43</sup>

Hospital leaders should look toward those already successful with Lean implementation within healthcare and manufacturing to learn from others' experiences.<sup>43</sup> Large healthcare systems, such as the University of Michigan Medical Center and Virginia Mason Medical Center, adopted components of TPS into their cultures. As a result, both experienced improved metrics, including increased patient satisfaction, better outcomes, and reduced waste.<sup>43</sup> Denver Health saved over \$114 million with the application of lean principles.<sup>58</sup>

Examples of TPS in healthcare are numerous:

- Time savings and advanced levels of nursing care were identified at Pittsburgh Regional Healthcare (PRH) when lean methodology was instituted.<sup>47</sup> Today, PRH's thirty-five hospitals focus their TPS principles on patient safety and clinical initiatives.<sup>47</sup>
- Fifteen emergency departments (ED) who implemented TPS methodology reduced patient wait times and lengths of stay, as well as increased patient satisfaction.<sup>54</sup> One ED increased throughput volume from 70,000 patients to 85,000 in one year. Six months later, the number increased to over 105,000 ED patients. Managers credited the success to the strategic implementation of lean principles.<sup>54</sup>
- Culig and colleagues found when TPS was integrated into a new cardiac surgery program, the mortality rate was 61 percent less than the regional rate.<sup>59</sup> Avoiding possible complications with lean, generated a cost savings of \$3,497 per coronary artery bypass graft procedure.<sup>59</sup>

- Two adult hospitals owned by Spectrum Health Regional Health Care System, measurably improved availability and delivery of medications by applying TPS to existing procedures.<sup>16</sup> Reduced wait time for medications and enhanced efficiency of their pharmacies increased nursing and patient satisfaction.<sup>16</sup>

ThedaCare is an integrated healthcare delivery system consisting of five hospitals and twenty-seven clinics in Wisconsin.<sup>45</sup> This organization changed from reactive to proactive when lean was applied to its culture. ThedaCare actively pursues TPS strategies to improve patient care and prevent future crises.<sup>45</sup> This revolution is the result of identifying daily continuous improvement opportunities by front-line workers. Many steps throughout ThedaCare's facilities were standardized using lean principles, such as the process of care delivery for patients with diagnoses of pneumonia, septicemia, and heart problems.<sup>45</sup> Standards were supported with evidence-based literature and the consensus of healthcare professionals where research did not exist. Today, supporting the CI component of TPS, physicians and nurses meet quarterly to review existing standards and discuss new research.<sup>45</sup>

#### *TPS and Patient Satisfaction*

Healthcare systems are constantly monitoring patient satisfaction scores due to the threat of decreased reimbursement.<sup>17</sup> A central concept of TPS, which helps with this issue, explores and appreciates the customers' perspective.<sup>17</sup> Embracing the view of the patient perspective is a large reason TPS has been attractive to the healthcare industry.<sup>43,54</sup> Both internal and external processes are examined through the customers' eyes.<sup>43</sup> Actions that do not create value for the patient are recognized and immediately eliminated.<sup>54,60</sup> This improves all phases of the patient experience, while delivering low cost, high-quality health services from motivated employees.<sup>45</sup>

*Lean Healthcare and Quality Improvements*

CI is a key principle of TPS.<sup>17,49</sup> Identified by Drotz and Poksinska, lean within healthcare generally revolves around CI and problem solving activities.<sup>17</sup> This environment prompts employee engagement and cooperation, even among high-level medical providers. Despite supporting literature, CI is often not embraced within traditional healthcare organizations.<sup>61</sup> When daily problems arise, healthcare workers often work around setbacks, without bringing issues to attention. A provider's focus on safety and comfort for the patient may delay or distract the attention away from addressing the interruptions.<sup>61</sup> Problems are often hidden rather than exposed and seen as an opportunity for improvement.<sup>62</sup>

Lean organizations examine all areas for improvement.<sup>62</sup> Benefiting healthcare professionals and patients, resources and time are appropriately allocated, ensuring successful CI implementation.<sup>17</sup> Employees experience increased authority and responsibility, teamwork, two-way communication, and attend routine meetings to discuss progress. If properly integrated into a daily work schedule, staff is more likely to view CI as beneficial and positive.<sup>17</sup>

*TPS and Rural Community Hospitals*

With limited access to labor and resources, rural community hospitals, with 100 beds or less, generally have lesser amounts of capital than larger facilities.<sup>44</sup> Accrediting agencies place the same regulatory requirements of quality, standards, and safety on hospitals, despite size. With frequent policy, market, and regulation changes, it is critical for rural providers to monitor healthcare costs.<sup>44</sup> Other intensified challenges for community hospitals with limited incomes, include rising labor and material costs, limited human resources, extreme competition, and stringent performance standards.<sup>44</sup> Community Health Systems responded to these concerns by

implementing TPS principles throughout its small rural hospitals, seeking flawless accreditation audits and performance improvement in safety, quality, and cost reduction.<sup>44</sup>

### *Barriers to TPS in Healthcare*

Large scope projects that are unachievable with the time allotted, create immeasurable outcomes, possess limited resources, and focus on incorrect priorities are challenges for successful lean implementation.<sup>63</sup> The entry barriers of TPS into healthcare include staff perceptions and cultural frictions. Healthcare workers often have negative feelings toward TPS, as they question how the adoption of a Japanese automobile company's methods, principles, and tools are applicable to the medical profession.<sup>44,64</sup> Planned and careful application of TPS in a healthcare setting is critical for staff buy-in.<sup>17</sup>

### TPS and Surgery

Mason, Nicolay, and Darzi conducted a systematic review of lean methodologies applied to surgery.<sup>65</sup> Utilizing lean concepts, several studies successfully reported increased outpatient efficiency and reached optimization.<sup>66,67</sup> Results included significant reductions in surgical wait times, improvement of patient satisfaction surveys, and increased patient volumes.<sup>67</sup> Research also identified positive results for improvement of surgical case on-time starts, turnovers, and throughput times.<sup>21,68-70</sup> Perhaps most important was the successful application of lean to reduce surgical complications through standardization of surgical techniques, as identified in several studies.<sup>71-73</sup>

### *TPS and Surgical Waste*

During laparoscopic cholecystectomies, bile duct injuries occur at 95 defects per million opportunities (DPMO).<sup>74</sup> If this error was tolerated within the aviation industry, the United States



would experience twenty commercial airplane crashes daily.<sup>74</sup> According to lean, inefficiencies and *muda*, the Japanese word for waste, are not tolerated.<sup>58</sup> The main goal of TPS is to identify and eliminate wasteful steps which do not add value to the overall process or end user.<sup>21</sup> By applying lean methodology, the following different types of waste can be reduced in surgery and anesthesia:<sup>2,75</sup>

- Overproduction waste is defined as processing an order based on routine schedule despite current demand.<sup>75</sup>
  - *Example:* Current literature does not support pre-anesthetic testing without a clinical indication.<sup>75</sup> Experts believe the chances of finding a significant abnormality in laboratory tests, EKGs, and chest x-rays, are small in healthy, American Society of Anesthesiologists grade 1 patients.<sup>75</sup>
  - *Solution:* Applying the lean strategy, just-in-time, ensures the right material is in the right place at the right time.<sup>75</sup> Utilizing this strategy with preoperative screening processes avoids unnecessary testing.<sup>75</sup>
- Waste is often experienced within inventory of the anesthesia and surgical departments, as supplies are often purchased before the previous ones are used.<sup>75</sup>
  - *Example:* Inventory waste of excess stock occupies valuable space, clutters shelves, and potentially expires before being used, creating an inefficient process of supply shuffling.<sup>75</sup>
  - *Solution:* Applying a lean strategy, the 5s tool, ensures the department sorts, sets in order, completes systematic cleaning, standardizes, and sustains.<sup>75</sup>
- Waiting is a form of waste within the surgical department.<sup>75</sup>
  - *Example:* Waiting occurs when staff are nonproductive.<sup>75</sup>
  - *Solution:* The lean strategy, value stream mapping, analyzes the flow of information and materials required to bring a service or product to the customer.<sup>75</sup>
- Waste of over-processing occurs when routine medical interventions are performed without supporting evidence.<sup>75</sup>

- *Example:* The routine use of a blended anesthetic using regional and general anesthesia (GA), or peripheral nerve blocks and GA, is not routinely supported in literature.<sup>77</sup> Research concludes local anesthetic infiltration of the wound and GA are just as effective, and less costly, than the other options.<sup>75</sup>
- *Solution:* Creating protocols and standardization are lean strategies for managing waste of over-processing.<sup>75</sup>
- A defect is an intervention performed at a later stage in the perioperative period because an error was carried downstream through the process.<sup>75</sup>
  - *Example:* Poorly followed processes and checklists cause unnecessary delays in patient care and may cause the wrong operation to be performed on the wrong site or wrong patient.<sup>75</sup>
  - *Solution:* Standard operating procedures are used to prevent defects.<sup>75</sup> Uniformity of a specific function can be achieved with lean by using detailed, written instructions.<sup>75</sup>

### TPS Summary

Traditionally in medical research, investigators examined before and after effects of an intervention.<sup>78</sup> Processes, employees' roles, behaviors, engagement levels, leadership styles, and work characteristics were rarely considered. These factors are supported with TPS, flattening hierarchies between professional groups.<sup>17</sup> Lean organizations' employees feel valued, respected, and appreciative of extra responsibility when influencing change within the hospital system. Literature has proven TPS in healthcare fosters staff development, positively affects the healthcare environment, and improves organizational performance.<sup>17</sup> Employees are willing to accept increased responsibility when improvement in daily activities is observable.<sup>17</sup>

## Methodology and Study Design

The overseeing Executive-level leadership of this Capstone project included:

- COO of Aspirus Ontonagon Hospital (AOH)
- COO of Aspirus Grand View Hospital (AGV)
- CEO of Aspirus Iron River Hospital (AIR)

Key contacts for this Capstone project were:

- Site Coordinator and Director of Surgery at AOH
- Surgical Department Supervisor at AGV
- Director of Surgery at AIR

Key contacts were responsible for collecting and submitting requested information to the author in a timely manner. When additional data was needed, key contacts were emailed individually with specific questions. Executive leadership received email notification when assistance was needed with data collection.

Data was collected during normal work hours, causing staffing costs of key contacts to be the greatest expense for this project. Administration at each hospital agreed to cover the expense for this task to be completed. The author limited communication to key contacts during the workday, as to not interfere with their primary responsibilities. Data examination and literature review was completed during the author's personal time.

Personal bias was the main ethical consideration for this Capstone project. The author's judgment was encouraged from Executive-level leadership. The author ensured recommendations were based on each hospital's data and evidence-based literature; professional opinions were expressed where appropriate.



**Implementation/Analytic Plan/Data Collection**

After initial face-to-face meetings with Executive-level leaders, key contacts at four UP hospitals were appointed by either the CEO or COO at each facility. On May 30<sup>th</sup>, 2015, an initial email was delivered with a survey, requesting information to be returned by July 1<sup>st</sup> (Appendix B). Three of the four hospitals submitted useable data. The University of Michigan-Flint's Institutional Review Board (IRB) determined the research for this Capstone project was not-regulated, as the data was gathered from an organization (Appendix C).

Key contacts used email to deliver each anesthesia and surgical department's information to the author. Conclusions were drawn after the data was entered into an Excel spreadsheet and analyzed. Facilities were compared and Excel was used to compute calculations from available financial reports.

**Dissemination Plan**

The final products completed for this Capstone project were:

- The author presented preliminary findings to Executive-level leaders on November 9<sup>th</sup>, 2015, through the Aspire to the Future Leadership Program.
- An extensive summary of current literature and the author's recommendations drawn from the UP hospitals' data and professional experience, was prepared in book format for dissemination to Executive-level leaders of Aspirus, Inc.

## Evaluation

The initial anesthesia and surgical email contained a survey for key contacts to complete.

The following dates show when the information was returned to the author:

- July 2<sup>nd</sup>, 2015: AOH (Appendix D)
- August 9<sup>th</sup>, 2015: AIR (Appendix E)
- September 10<sup>th</sup>, 2015: AGV (Appendix F)

Several additional emails were exchanged between the key contacts and the author to request additional information where the survey was not completed. One example of this communication can be found in Appendix G. An Excel spreadsheet was used to compare the anesthesia and surgical departments in the participating hospitals (Appendix H).

### Anesthesia Department Comparison

The anesthesia department models for the three participating hospitals were:

*Aspirus Grand View (AGV)*: Non-medically directed, all-Certified Registered Nurse Anesthetist (CRNA) practice employing four full-time CRNAs; covers call for entire hospital, 24 hours a day, 365 days of the year

*Aspirus Ontonagon (AOH)*: Non-medically directed, all-CRNA practice but no permanent staff; hires only locum CRNAs when needed approximately four to five times a month

*Aspirus Iron River (AIR)*: Employs one Anesthesiologist and one non-medically directed CRNA rotating schedules (usually two weeks on/two off); covers call for entire hospital, 24 hours a day, 365 days of the year

Current staffing models offer minimal levels of anesthesia capacity. Aspirus UP hospitals must meet demands from locum anesthesia providers to maintain uninterrupted anesthesia services when permanent staff is off. Contracted labor expenses reported by the three hospitals

include agency fees, mileage, housing, food costs, and beeper/call pay. At any rural CAH, it is challenging to accurately plan anesthesia needs due to the variability of surgeons and patient volumes. Each facility must carefully weigh the expenses of adding additional permanent anesthesia providers when the service lines grow and surgical specialties are expanded. If the volume of surgical procedures suddenly decreases, the CAH must consider the risk of employing an underutilized anesthesia department.

### Aspirus Grand View (AGV)

#### *AGV's Anesthesia Department*

Four, full-time CRNAs cover services throughout AGV, including the emergency department (ED), medical/surgical floor (med-surg), intensive care unit (ICU), obstetrics (OB), and radiology. Call coverage is provided every day of the year for the hospital by the CRNAs.

In 2014, AGV only had two CRNAs covering all anesthesia and emergency needs of the hospital due to the loss of a provider. The lack of staff created anesthesia bottlenecks within the surgical department. Locum CRNAs were utilized almost daily to fill the void. An eleven month period of locums followed, impacting both fiscal year 2014 and 2015, where the hospital paid over \$300,000 to contracted services. This is the cost of one-and-a-half permanent CRNA salaries.

In 2014, AGV's COO approved hiring a fourth CRNA for AGV. An additional provider would allow the CRNAs to have a float provider who would expedite daily anesthesia services and eliminate anesthesia bottlenecks caused by surgeons waiting for an anesthesia provider to finish a case before the next case begins. The float CRNA's duties consist of completing preoperative anesthesia assessments, peripheral nerve blocks, chart reviews, and other necessary

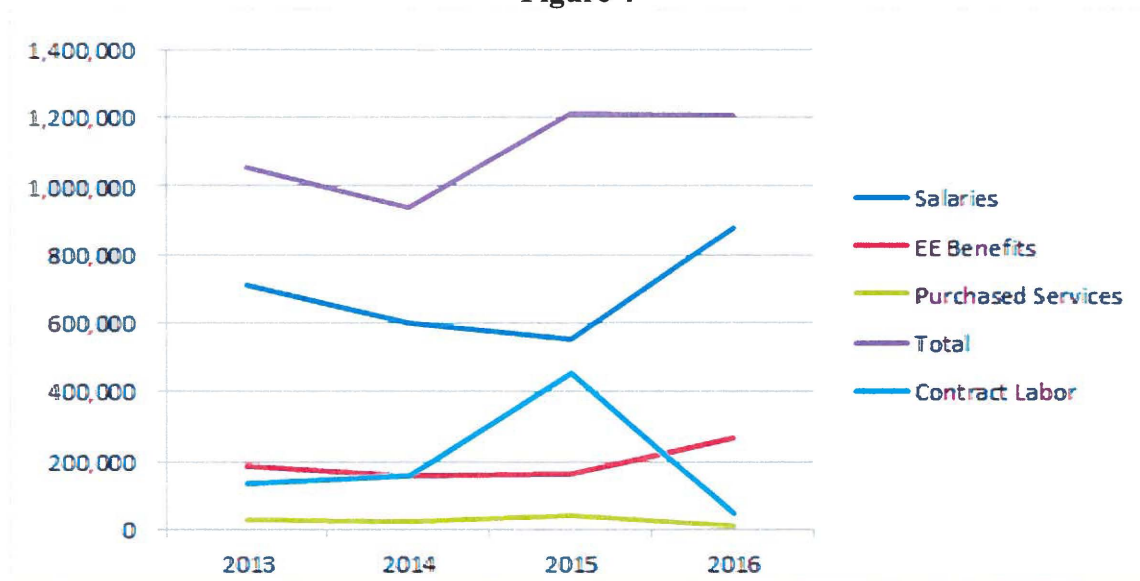
responsibilities arising during the workday. Those tasks include difficult IV starts, epidurals, intubations, and anesthesia for emergency add-on cases. The rotation of CRNAs to AOH would also be possible to provide services for AGV's surgeons who already travel to that hospital. The fourth provider would also allow permanent staff to cover their own time off, causing the expenses of contracted services to decrease.

CRNAs are given five weeks of vacation each, totaling twenty weeks of vacation annually. This leaves the anesthesia department with only three providers nearly 40 percent of the time. Locum CRNAs are occasionally employed on the vacation days of permanent staff to meet the surgical schedule needs. They are paid a daily rate of \$1,200, plus mileage, housing, beeper/call pay, and receive free food in the hospital's cafeteria.

#### *AGV's Anesthesia Department Budget and Variance Analysis*

The total costs for fiscal year 2016 are expected to decrease throughout the year despite the addition of a fourth CRNA salary. Contracted services are expected to decline dramatically from last year due to the additional provider and subsequent nominal locum usage (Figure 4). The expense of contracted providers has dropped below excessive overtime costs for the first time.



**Figure 4**

The nurse anesthetists at AGV are salaried, hospital-employed providers who receive benefits and malpractice coverage. The CRNAs' base salaries include \$20,000 of call pay. Excessive call requires the facility to pay more than the base salary to the provider, based on the number of value units. Estimates created from the budget and variance report, predict AGV will pay approximately \$83,000 in excessive overtime during fiscal year 2016. This is nearly half the salary of hiring a fifth provider.

The data review showed how the loss of one salaried CRNA resulted in the hospital paying more for locum services than the total cost of the permanent providers. The risk of using locum providers, due to three or less employed CRNAs, justifies the cost of employing a fourth provider at AGV. This was a sound decision from hospital administration.

The greatest finding from the data analysis suggests the anesthesia department is underutilized. With thorough evaluation, the author of this paper concluded the underlying problem is the mismanagement of the surgical schedule, where providers administer the bulk of

their anesthesia services. The poorly planned schedule has failed to properly utilize the benefits of employing a fourth CRNA, creating unnecessary costs to the hospital.

### *AGV's Surgical Schedule*

In October 2015, management initiated a new block schedule in an attempt to streamline surgical flow. Prior to implementation, the block schedule was reviewed by providers and adjusted to their preferences, allowing all four rooms to be in use every day with the same 8:00 AM start time as seen in Figure 5. Four first starts in the day immediately created a bottleneck for the anesthesia department. A float provider was not available to provide spontaneous anesthesia services required in other departments, such as labor epidurals. Angry surgeons were frustrated by waiting on anesthesia providers to become available for their case. The new block schedule failed to reach its objective, creating a disastrous trail of upset staff and delayed surgical cases.

**Figure 5**

	OR-1	OR-2	OR-3	Endo
Monday	Dr. Khalife Every other	Dr. Braucher Big Cases	Dr. Braucher	Dr. Santini
Tuesday	Dr. Lukes Totals	Dr. Nigam Vitrectomy	Dr. Swan- Totals Dr. Carlson-every 6 weeks	Dr. Braucher Dr. Santini
Wednesday	Dr. Santini	Dr. Stempihar	Urgent Cases	Dr. Braucher
Thursday	Dr. Braucher	Dr. Nigam- cataracts Dr. Stempihar	Dr. Lukes Small Cases	Dr. Santini
Friday	Dr. Khalife Every other	Dr. Swan Small Cases	Urgent Cases Dr. Wood every 3 <sup>rd</sup> Friday	Dr. Braucher Dr. Santini

Presented below are three examples of how the anesthesia department at AGV is underutilized and burdened with unnecessary costs, due to the inefficient block schedule:

- September 17, 2015: Fifteen surgical hours were performed. With room turnover and delays, the day lasted for seventeen hours. The three permanent anesthesia providers, offered twenty-one hours of total anesthesia time. This was more than sufficient time to provide safe, high-quality anesthesia services to AGV's patients. A locum provider was hired, costing the hospital an unnecessary \$1,200 plus mileage, in addition to \$2,000 in permanent salaries.
- September 18, 2015: Six surgical hours were performed. Two permanent CRNAs were scheduled to work, providing a total of fourteen anesthesia hours. Management hired a locum for three surgeons to start at 8:00 AM. The day was completed by noon with the hospital still paying a contracted provider \$1,200 for a guaranteed, eight-hour day, plus mileage.
- September 30, 2015: Twelve surgical hours were performed. Two permanent CRNAs were scheduled to work, providing a total of fourteen anesthesia hours. A locum provider was hired, increasing underutilized anesthesia time and adding unnecessary costs to the department.

The above are examples of an inefficient block schedule creating a strain on the anesthesia department's budget. If surgeons were staggered throughout the day, providing better patient flow, AGV would have saved over \$4,000 in unnecessary anesthesia-related costs during September 2015.

Anesthesia department underutilization is due to a lack of patient flow throughout the day. Numerous patients are being admitted during the morning to accommodate four surgeons' first-starts. This creates a rush of patient admissions at the beginning of the day and again when the same patients are discharged. The wide swings of patient volumes cause unnecessary stress on staff, as well as frustrate patients and their families when service is not prompt and punctual. Another patient flow problem occurs when patient volumes are not coordinated with the surgical



schedule. Some days have only two or three surgeries, while others have zero patients scheduled. Slow days are followed by chaotic days with an overloaded caseload of eighteen or more. The schedule is never evened out with a similar number of cases per day.

With the current block schedule, elective, scheduled surgeries are allowed to start anytime throughout the day, potentially creating unnecessary overtime costs for surgical employees. The allowance of surgeons to schedule cases at their discretion and operate outside of their block time has supported the repeated demand for crisis management from staff. Lack of ownership over the block schedule has generated unnecessary tangible and intangible costs and continues to decrease department morale at AGV.

Poor implementation of the block schedule and lack of scheduling policies at AGV resulted in inconsistent patient flows, underutilization of anesthesia providers, frustrated staff, and surgeons running the OR schedule as they wish. The situation created an inability to plan appropriate anesthesia needs for the surgical department. In conclusion, decisions to change the anesthesia department staffing model or hire locum providers may be inaccurately based on errors related to the surgical schedule.

### Aspirus Ontonagon Hospital (AOH)

#### *AOH's Anesthesia Department*

AOH does not employ permanent anesthesia providers. On an as-needed basis, they hire from a pool of ten locum CRNAs, working under two contracts. The locums' guaranteed daily rate ranges from \$1,000 to \$1,200 for an eight hour day. Call is never required. Per the locums' contracts, the daily rate increases to \$1,400 if call coverage was needed. Mileage is reimbursed at the standard IRS rate and averages \$100 to \$115 per trip. For the first seven months of 2015,



locum salaries and mileage totaled \$25,000 for the anesthesia department. If overtime is needed, it is provided at \$125 to \$150 per hour for any services necessary after an eight hour day. If the hospital needs to cancel services, the daily rate of \$1,200 must be paid if the CRNA is given less than one week's notice. AOH is also responsible for providing meals and lodging if lengthy travel is required.

Credentialing for locum CRNAs initially costs \$50, then \$45 per person every two years. This amounts to \$225 per year for maintaining credentialing of the ten CRNAs. AOH also pays for two types of insurance, as required by applicable laws, when locum providers are on-site. They include worker's compensation insurance and professional liability insurance, as required by law. Malpractice consists of a minimum amount of \$1,000,000 for each occurrence and \$3,000,000 for all occurrences in one policy year. This costs \$147 annually using Coverly's insurance and is maintained for at least ten years following the termination of a locum's contract.

#### *AOH's Supply Chain*

Anesthetic gases are often the highest operational expense in many hospital-based anesthesia practices.<sup>12</sup> AOH has Narkomed anesthesia machines with three anesthetic gases, including isoflurane, sevoflurane, and desflurane. However, the author of this paper believes the ordering and stocking of all gases is excessive for the volume of general anesthetics performed at AOH. Elimination of even one gas could reduce the anesthesia department's drug-related costs.

#### Aspirus Iron River (AIR)

##### *AIR's Anesthesia Department*

One anesthesiologist and one CRNA are employed at AIR. They currently work part-time, splitting the month by usually working two weeks on and two off. The anesthesia

department covers the ED, as well as IV starts and intubations necessary in the ICU and med-surg. Providers typically work an average of five to six hours a day and cover every night with call. When staff request the same day off, a locum CRNA is hired. Approximately seven to ten days over the last two years have required contracted services.

#### *AIR's Anesthesia Department Budget and Variance Analysis*

In the June 2015 budget and variance report, the cost of the locum provider was approximately \$1,100 for one day. Compensation packages for permanent providers were not examined in this Capstone project; these providers are salaried. Call pay is calculated into their total compensation. AIR's expenses do not fluctuate like AGVs, because the department is not concerned with excessive overtime costs. When examining the budget and variance report, AIR's anesthesia department costs are controlled.

#### *AIR's Surgical Schedule*

AIR's anesthesia department and its ORs are utilized over 50 percent of available time. Unlike AGV, who performs many local and IV sedation cases using only nursing staff, anesthesia providers at AIR are not as underutilized because the majority of their cases require anesthesia. Anesthesia still remains the greatest bottleneck within the departments, similar to AGV.

Running two operating rooms simultaneously on the same day is impossible, unless two anesthesia providers are present. Although this occurs about once a month, AIR's surgical department remains constrained by its anesthesia staff. AIR's surgical capacity is completely dependent on its anesthesia capacity. Delayed anesthesia turnovers push cases late into the day, regularly running into after hours. Due to inaccessible financial information from the surgical department, the author of this paper was unable to view the surgical department's overtime

staffing costs. Based on interviews with surgical personnel, the number of late cases caused by anesthesia delays are numerous and occur frequently.

#### *AIR's Current Practices and Evidence-Based Research*

Personal work experience at AIR assisted the author with identifying additional concerns stemming from the lack of evidence-based research application to current practices. Patients are transferred to recovery after every case, even if they are immediately awake after monitored anesthesia care. The recovery room may be appropriate for some patients, but this is not applicable for all, nor supported by best practice. Stable patients are able to bypass recovery and can be fast-tracked to discharge. The recovery room charge is an unnecessary cost for many patients.

At AIR, everyone over age 55 must have an electrocardiogram completed prior to his/her procedure, including healthy patients with no evidence or history of heart problems or hypertension. Within the last decade, current literature supports minimal pre-surgical testing, unless warranted by an existing medical condition. Research has determined the chance of finding an immediate contraindication to anesthesia from a pre-operative test, such as an EKG, is very low.<sup>76</sup> In addition to not being supported by evidence-based practice, unnecessary pre-operative testing places avoidable financial burden on patients.

#### Evaluation of the Budget and Variance Reports

At AGV, the only financial report available for surgical management is the Enuff budget and variance report created by corporate and emailed monthly. It includes a multitude of small departments, including ambulatory, surgery, recovery room, anesthesia, and central supply, but lacks the ability to show patient flow. Each mini-department constitutes a silo without the ability

to see how one affects the other. When printed, the September 2015 AGV surgical budget and variance report was 157 pages long. Surgical managers at AGV, AOH, and AIR rely on budget and variance reports for decisions. Levels of experience with this report are varied, causing some decisions within the departments to ignore financial concern.

Surgical managers at AGV and AIR created their own dashboards by manually entering data from different sources, attempting to generate some insight into their own departments. Manual extraction of data is time consuming and distracts the manager from fulfilling other important responsibilities. This is an example of a system failure which RASN could examine. By providing necessary support for nursing leaders in the most difficult areas of their jobs, business and finance, RASN can help place more important metrics at their fingertips for faster analyses and better decision making. Specifically in surgery, management can monitor product costs, supply cost per surgeon, and supply cost per case.<sup>79</sup>

How does anesthesia or surgery influence the larger financial performance of the hospital? What is the department's contribution margin? The answers remain unknown. When searching for financial reports to compare the surgical department to other areas of the facility, AGV's COO informed the author that a report of this quality does not exist. The corporation is actively working on creating one. Until then, it is impossible to analyze the financial picture of the hospital without directly comparing each department's lengthy budget and variance report.

Another concern with the Enuff budget and variance reports is the facilities cannot determine the amount of hospital subsidization per department. When AGV spent over \$300,000 on locum use in 2014, it is unclear where the money came from and what other programs suffered within the hospital as a result. It is clear subsidization does occur; the amount of subsidization is unclear.



*AGV's Existing Problems*

Surgical department nurse managers most likely have difficulty interpreting the Enuff budget and variance report due to accounting allocations. For example, a surgical silo, the recovery department, showed negative values for hours worked and staff salaries. In order to examine the effect of RASN on AGV, the author combined the surgical silos for September 2015. The data in each department was tallied to create total costs and revenue. To illustrate actual flow through the entire surgical department, all silos were summarized as exhibited in Table 1.

**Table 1**

<b>AGV Actual Data from September 2015 Enuff Budget and Variance Report: Department Totals</b>								
<b>Dept. Code</b>	<b>Dept.</b>	<b>Net Pt. Revenue</b>	<b>Net Income</b>	<b>Worked Hours</b>	<b>Total Salaries</b>	<b>Benefits</b>	<b>Purchased Services</b>	<b>Medical Supplies</b>
136	ACU	32,667	2,275	474	14,347	4,563	1,965	8,636
160	Surgery	282,750	67,697	1,631	52,260	16,621	12,379	113,234
163	Anes. Pro	198,491	198,491	0	0	0	0	0
165	Recovery	12,598	12,625	-2	-56	-18	0	46
166	Anesthesia	17,735	-78,440	512	61,073	19,424	10,120	5,447
400	Central Sup.	20,804	10,671	137	1,723	548	40,480	2,415
<b>Surgical Nursing</b>				<b>2,240</b>	<b>\$68,274</b>	<b>\$21,714</b>	<b>\$54,824</b>	<b>\$124,331</b>
<b>Anesthesia</b>				<b>512</b>	<b>\$61,073</b>	<b>\$19,424</b>	<b>\$10,120</b>	<b>\$5,447</b>
<b>Entire Surgical Dept.</b>		<b>\$565,045</b>	<b>\$213,319</b>					

Dept=Department; Pt.=Patient; ACU=Ambulatory Care Unit; Anes.=Anesthesia;  
Pro=Professional Fee; Sup.=Supply

Through examination of AGV's September 2015 Enuff budget and variance reports, the author concluded:

- The departments must allow ten nursing minutes to produce one surgical minute
  - Calculated by taking total September 2015 nursing minutes of 134,400 divided by total surgeon minutes of 12,69
  - In September 2015, nurses worked 121,709 minutes or 2,028 more hours than surgeons

- In September 2015, the surgical department was open for a total of 38,000 minutes (Table 2)
  - Only 12,000 minutes were used for surgery
- On average, AGV only operates at 33 percent of its capacity
  - National capacity for an OR is 68 percent.<sup>34</sup>
  - Based on the national average, AGV should have only been open for 17,647 minutes in September; the department was running with staff and overhead for twice that amount
- Staff are cross trained between the surgical silos
- AGV is the largest of the three participating hospitals
- Excess capacity, or the number of non-productive minutes the OR is open but not in use, is the greatest loss within the department (Table 3)

**Table 2**

<b>AGV OR Availability</b>			
	<b>Hours/Week</b>	<b>Hours/Month</b>	<b>Minutes/Month</b>
OR 1	40	160	9,600
OR 2	40	160	9,600
OR 3	40	160	9,600
Endoscopy	40	160	9,600
<b>Total</b>	<b>160</b>	<b>640</b>	<b>38,400</b>

**Table 3**

<b>AGV Surgical Excess Capacity Examination</b>			
		<b>Formula</b>	
A	Total Surgeon Minutes	<i>Enuff B&amp;V</i>	12,691
B	Total Available OR Minutes/Month	<i>Total from Table 2</i>	38,400
C	Percentage of Minutes Used	$A / B$	33%
D	Wasted OR Minutes	$B - A$	25,709
(Assuming all expenses are variable & will occur with each additional OR minute)			
E	Net Income from Operations (NOI)	<i>Total Revenue from Table 1</i>	\$213,319
F	NOI/Surgeon Minute	$E / A$	\$16.81
G	Lost Income on Unused Minutes	$F * (B - A)$	\$432,134
(Assuming all expenses were fixed and incurred in the previously used OR minutes)			
H	Total Net Patient Revenue	<i>Total Revenue from Table 1</i>	\$565,045
I	Revenue per OR Minute	$H / A$	\$44.52
J	Lost Revenue on Unused Minutes	$I * D$	\$1,144,649
Lost Income on Unused Minutes			\$432,134
Lost Revenue on Unused Minutes			\$1,144,649
<b>Average Excess Capacity</b>			<b>\$788,392</b>

NOI=Net Operating Income B&V=budget and variance

With RASN, one solution to improve the financials of the department requires restructuring the surgical department to ten hour workdays. The department would be open Monday to Thursday. Staffing would start as normal at 7:00 AM and end at 5:30 PM, with surgical availability from 8:00 AM to 5:00 PM. During this time period, AGV could service their existing caseload, while decreasing staffing costs and overhead. The on-call staff would provide services for the fifth day of the week, Fridays, and weekends, for urgent and emergent cases. Fridays were specifically chosen as the closed week day, as it typically has the smallest amount of cases and surgeons, and is requested the least from patients.

The transformation into ten hour work days at AGV will not be successful without RASN. Using preliminary results from this Capstone project, AGV's administration surveyed surgeon and staff attitudes toward ten hour days. The presentation of the idea was timid and the



results were negative. Surgeons and staff did not have the education they needed to understand the benefits of ten hour days. With the support of RASN's Director, surgeons, anesthesia providers, and surgical staff would have tools available to understand the rationale behind the idea, thus creating greater buy-in.

*Application of RASN with Restructuring to Ten Hour Shifts at AGV*

With longer days, and a flow of patients throughout the day, the same amount of surgeries can be performed with fewer providers. Theoretically, the existing caseload can be handled by only two CRNAs when scheduled appropriately on ten hour shifts. When applying this idea, the first expense to be eliminated would be locum anesthesia providers at \$40,000 (Table 4). Up to two permanent staff would be able to request days off simultaneously, while the other two providers cover the needs of the facility. Malpractice and credentialing costs can be decreased by \$10,000, as coverage for locums would no longer be required. Relying on fewer providers each day would allow AGV's anesthesia providers to freely float to AOH when anesthesia services are needed for \$1,000 per day. Traveling to AOH twice a month, \$24,000 revenue is available to the anesthesia department from AOH by sharing providers. With RASN, the largest savings experienced would be the reduction of excessive overtime, or the number of overtime hours worked above and beyond a permanent CRNA's base salary. A large number of cases would be completed during normal work hours, thus decreasing hospital subsidization for the anesthesia department.

**Table 4**

<b>AGV Anesthesia Department Savings with RASN</b>	
Locum Expenses	40,000
Malpractice Locums	5,000
Credentialing	5,000
Excessive Overtime	80,000
Regional Staff Reimbursement	24,000
<b>Total Anesthesia Savings</b>	<b>\$154,000</b>



The restructuring to ten hour shifts through RASN would provide savings in nursing salaries. With this change at AGV, the surgical nursing staff can work more efficiently, doing more work with fewer employees, as with anesthesia. Using the September 2015 budget and variance report numbers, ten hour shifts could decrease labor and benefits by 30 percent (Table 5). Four full time nursing positions could be reallocated. The nursing to surgical minute ratio would decrease from 10:1 to 7:1, removing waste and increasing efficiency within nursing. Total savings for nursing labor are over \$300,000 as seen in Table 6.

**Table 5**

<b>AGV Nursing Labor Reduction with RASN</b>			
		<b>Formula</b>	
A	Total Nursing Hours Worked	<i>Table 1 Surgical Nursing Total</i>	2,240
B	Total Nursing Minutes Worked	$A * 60$	134,400
C	Total Surgeon Minutes Worked	<i>Enuff B&amp;V</i>	12,691
D	Nursing Minute to OR Minute	$B/C$	10.59
E	30% Reduction	<i>30% reduction from 10:1 to 7:1</i>	4 FTE
F	New Nursing Capacity	$B * 0.7$	94,080
G	New Nursing Minute to OR Minute	$F/C$	7

**Table 6**

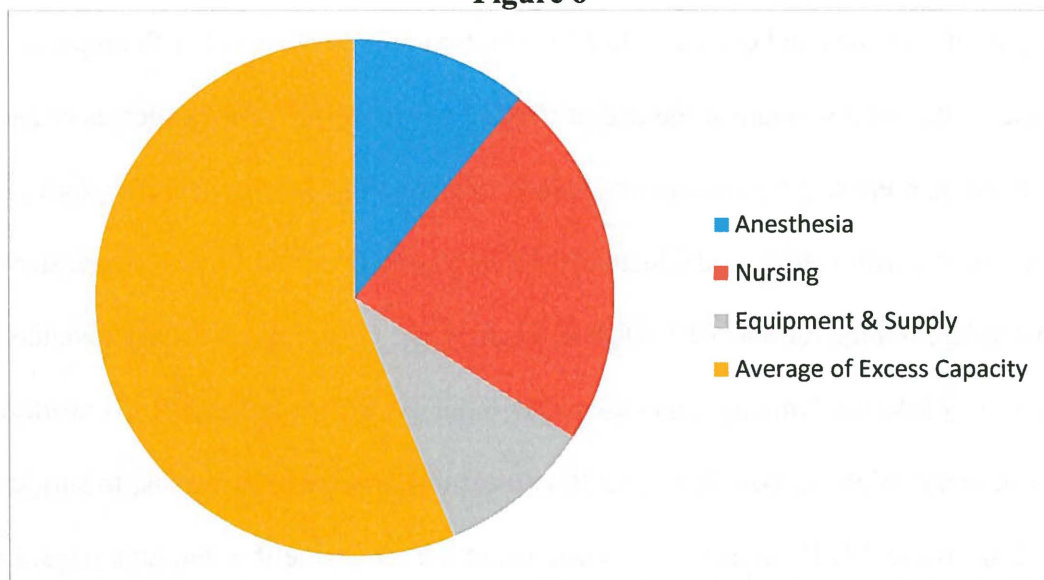
<b>AGV Surgical Nursing Department Savings with RASN</b>		
	<b>Sept. 2015 Sample</b>	<b>Annual</b>
30% Labor Reduction	20,482	245,786
30% Benefit Reduction	6,514.0	78,170
<b>Total Surgical Nursing Savings</b>		<b>323,957</b>

Supply chain management is another important area RASN can manage. By utilizing a central ordering program and sharing supplies as often as possible, a conservative estimate of 15 percent reduction in ordered supplies would potentially save \$136,366 (Table 7).

**Table 7**

<b>AGV Anesthesia &amp; Surgical Equipment/Supply Savings with RASN (Based on September 2015)</b>	
15% Reduction Purchased Services	116,899
15% Reduction Medical Supplies	19,467
<b>Total Equipment/Supply Savings</b>	<b>\$136,366</b>

Overall, RASN has the potential to greatly influence AGV's bottom line, with over \$1.4 million in savings as shown in Figure 6 and Table 8.

**Figure 6****Table 8**

<b>TOTAL RASN Savings at AGV</b>	
Total Anesthesia Savings	154,000
Total Surgical Nursing Savings	323,957
Total Equipment/Supply Savings	136,366
Average Excess Capacity	788,392
<b>Total Savings</b>	<b>\$1,402,714</b>

If transitioned from eight to ten hour days, many problems at AGV would be solved. The original goals of hiring a fourth anesthesia provider would be realized:

- Anesthesia would have a float provider available to serve the hospital while two perform anesthesia for the same amount of cases.
- Anesthesia would provide services to AOH
- Anesthesia would cover the department's vacations, even when two providers are off at the same time.

Typically, surgeons perform cases from 8:00 AM to 1:00 PM. An eight hour day for nursing begins at 7:00 AM and ends at 3:30 PM. The first hour is occupied with preparing for surgical cases. The last few hours at the end of the day may consist of duties such as ordering of supplies, cleaning, preparing equipment and ORs for the next day's surgeries, completing entries in the electronic medical record, and education. The extra hours of non-surgical work skews the nursing to surgical minute ratio to 10:1. During this time the OR is not producing revenue, but continuing to pay salaries. Nursing hours are only productive when staff is actively working with a patient in surgery. With ten hour days and 30 percent fewer nurses, the nursing to surgical minutes will decrease 7:1. Decreasing this waste is not the only benefit of ten hour days. Low morale stemming from lack of control over the surgical schedule and large swings in patient volumes would be reduced. Stabilizing patient flows, spreading work throughout the day, and evening out daily caseloads may reduce nursing frustrations from call-offs when census is low, or feeling obligated to leave before the end of their shifts when work is completed. Nursing satisfaction with Aspirus may improve as RASN alleviates many of AGV's existing nursing problems.

*RASN and AOH*

The author combined AOH's surgical silos from the July 2015 Enuff budget and variance report. The data in each department were tallied to create total costs and revenue. Table 9 summarizes the anesthesia and surgical departments.

**Table 9**

<b>AOH Actual Data from July 2015 Enuff B&amp;V Report: Department Totals</b>								
<b>Dept. Code</b>	<b>Dept.</b>	<b>Net Pt. Revenue</b>	<b>Net Income</b>	<b>Worked Hours</b>	<b>Total Salaries</b>	<b>Benefits</b>	<b>Purchased Services</b>	<b>Medical Supplies</b>
160	Surgery	45,352	29,803	49	1,425	0	3,268	8,917
165	Recovery	4,899	4,647	9	178	0	0	75
166	Anesthesia	8,080	1,930	0	0	0	3,915	2,235
<b>Surgical Nursing</b>				<b>58</b>	<b>\$1,603</b>	<b>\$0</b>	<b>\$3,268</b>	<b>\$8,992</b>
<b>Anesthesia</b>				<b>0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$3,915</b>	<b>\$2,235</b>
<b>Entire Surgical Dept.</b>		<b>\$58,331</b>	<b>\$36,380</b>					

Through examination of AOH's July 2015 Enuff budget and variance reports, the author concluded:

- The departments must allow four nursing minutes to produce one surgical minute
- On average, AOH operates at 56 percent capacity, higher than AGV
- Maintenance costs of equipment are fixed, despite lack of use
- Staff are cross trained between the surgical silos
- Employee benefits are not allocated to surgery
- AOH is the smallest of the three participating hospitals

AOH employs only locum CRNAs when procedures require anesthesia. The difference between the two types of providers is shown in Table 10.

**Table 10**

<b>AOH Anesthesia Department: Cost Comparison</b>		
	<b>Locum</b>	<b>Aspirus Provider</b>
8-Hour Guarantee	Yes	Yes
Hourly Rate	-	\$86.54
Daily Rate	\$1200	\$692.32
Malpractice Provided	Yes	Yes



Credentialing Required	Yes	Yes
Mileage	\$100 Flat Rate	\$63.72*
Average Number of Days Requiring Anesthesia Services	4	

If AOH utilized Aspirus employees through RASN, the costs for anesthesia would greatly decrease. Table 11 shows the savings AOH would experience if Aspirus providers were used, rather than locums.

Table 11

AOH's Anesthesia Department Labor Savings with RASN				
Days	Locum Daily Rate + Mileage	Aspirus Provider Daily Rate + Mileage	Monthly Savings	Annual Savings
1	1,300	756	544	6,528
2	2,600	1,512	1,088	13,056
3	3,900	2,268	1,632	19,584
4	5,200	3,024	2,176	26,112
5	6,500	3,780	2,720	32,640
6	7,800	4,536	3,264	39,168
<b>Total Savings</b>			<b>\$3,264</b>	<b>\$39,168</b>

Locums are nearly double the cost of an Aspirus employee. If anesthesia is needed for an additional eight hour day, current expenses are more for locums than an Aspirus provider cost. If AOH doubled their capacity from two to four days with Aspirus employees, this would increase anesthesia costs by \$424 per month or \$5,000 annually. Doubling the capacity would then double revenue, creating \$696,000 in additional annual revenue, costing the hospital \$5,000.

Surgical department nurses are not necessarily affected, as AOH utilizes their services in other areas of the hospital when surgeries are not being performed. The sporadic expenses of nursing salaries are minute and not concerning.

Like AGV, RASN can assist with supply chain management. This would be beneficial for AOH, resulting in over \$3,000 of savings (Table 12).

Table 12

AOH Anesthesia & Surgical Equipment/Supply Savings with RASN				
Department	Actual Expenses July 2015	Daily*	6 Days / Month	RASN Application**
Surgery	8,917	2,972	17,834	2,675
Recovery	75	25	150	23
Anesthesia	2,235	745	4,470	671
AOH Equipment/Supply Savings with RASN				\$3,368

Excess capacity for AOH is opposite AGV. AOH maintains, stocks, and readies a fully licensed and certified operating room. It is staffed and operational two to three days each month. Excess capacity was calculated by comparing the existing revenue potential of \$699,972 with the potential revenue of \$1,538,725. Currently, AOH is consolidating surgeon workload into a few days and achieving 56 percent utilization of available OR minutes. Multiplying AGV's revenue of \$44.52 per OR minute by the total available minutes produced a fairly modest prediction of AOH revenue. Increasing OR utilization to six days each month could more than double current revenue when considering the revenue potential demonstrated at AGV (Table 13).

Table 13

AOH's Excess Capacity				
Days of Operation Per Month	Daily Revenue	Annual Revenue Existing Daily Revenue X Days	Available OR Minutes	Potential Annual Revenue
1	19,444	233,324	480	256,454
2	38,887	466,648	960	512,908
3	58,331	699,972	1,440	769,362
4			1,920	1,025,816
5			2,400	1,282,271
6			2,880	1,538,725
				\$838,753

AGV and AOH have similar surgical departments, yet they are managed very differently. Special considerations were accounted for when computing RASN's effect on the departments. Some variation in calculations and heavy consideration must be given to each hospital, as the

CAHs are not identical. The vision of RASN is not cookie cutter; rather it embraces each facility's uniqueness and allows stakeholders an opportunity to work closely for optimization.

#### *\$4 Million Application of RASN in the UP*

Three hospitals, AGV, AOH, and AIR participated in this Capstone project. Aspirus also owns a fourth hospital, Aspirus Keweenaw (AKH), in the northern UP. Using the largest facility, AGV, and the smallest, AIR, the author of this paper was able to calculate the total savings RASN can bring to the four CAHs based on the averages of the two. RASN's savings in the UP could total \$1 million per facility, or \$4,568,007 for the system, as shown in Table 14.

**Table 14**

<b>Total UP Hospital Savings with RASN</b>				
	<b>AGV</b>	<b>AOH</b>	<b>AIR (Assumption*)</b>	<b>AKH (Assumption*)</b>
Anesthesia	154,000	39,168	96,584	96,584
Nursing	323,957	0	161,979	161,979
Equipment/Supply	136,366	3,368	69,867	69,867
Excess Capacity	788,392	838,753	813,572	813,572
	\$1,402,715	\$881,289	\$1,142,002	\$1,142,002
<b>Total Annual Savings in All Facilities with RASN</b>				<b>\$4,568,007</b>

## **Discussion**

### Geography & Competitors

AGV, AOH, and AIR are located in Michigan's UP (Figure 7).<sup>80</sup> Currently, 308,319 people reside within the rural peninsula, yet only twelve towns exceed 4,000 residents.<sup>81</sup> In 2012, those aged 45 to 64 years old were the largest age group. By 2017, the population over 65 years old is expected to increase by nearly 10,000 people.<sup>81</sup>



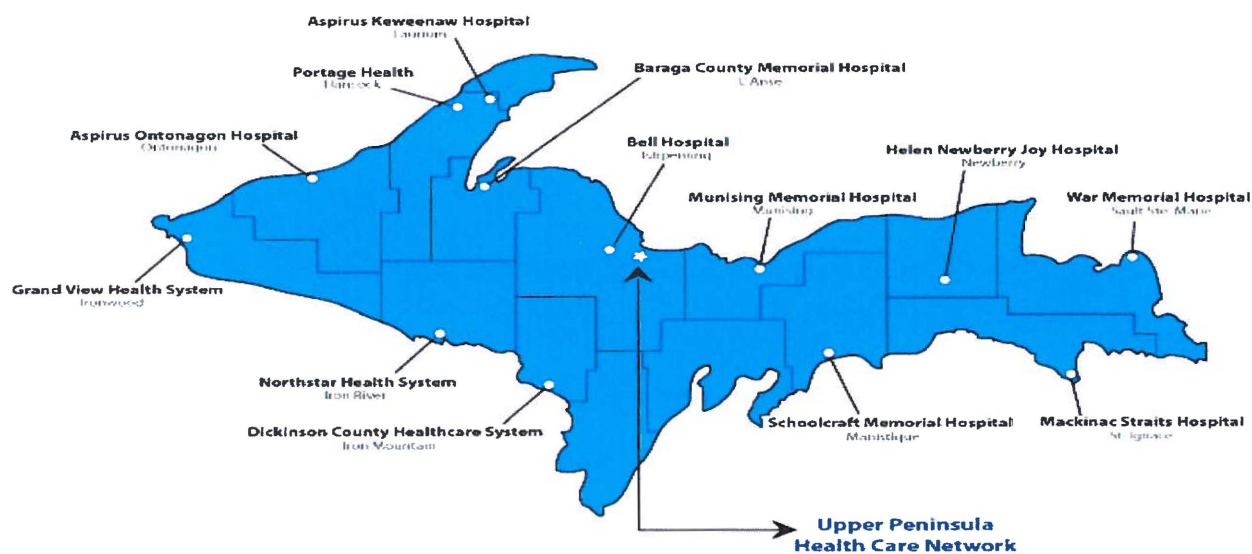
*Figure 7*

Resource: <http://www.aspirus.org/Main/Hospitals.aspx?srcaud=AspirusGrandViewHospital><sup>80</sup>

The participating Aspirus CAHs, AGV, AOH, and AIR, are located in Gogebic, Ontonagon, and Iron Counties, respectively.<sup>80</sup> The fourth Aspirus facility in the UP, AKH, is positioned in Keweenaw County. According to 2010 Michigan statistics, these four hospitals serve a base of 37,000 people.<sup>82</sup> Overall, the UP has experienced population declines.<sup>81</sup> From 2011 to 2012, Ontonagon and Iron Counties had an annual rate of -1.0 to -3.0 percent change in their populations.<sup>83</sup> Similarly, Keweenaw County declined by -0.5 to -1.0 percent. Only Gogebic County remained unchanged.<sup>83</sup>

Many Aspirus competitors are located in the UP, as shown in Figure 8.<sup>84</sup> They utilize different anesthesia department models and operate diverse surgical departments. No competitor has the opportunity to successfully implement a program like RASN. Locations of each Aspirus CAH, and the similarities between the departments, make it possible for providers and the Director to effortlessly float between facilities. Comparable equipment, case types, and anesthesia requirements create a unique opportunity for RASN to be successful.



*Figure 8*

Resource: <http://www.uphcn.org/uphcn/uphcnm.html><sup>83</sup>

As demonstrated throughout this Capstone project, RASN has the potential to fortify Aspirus' competitive advantage in the UP. ThedaCare, a competitor of Aspirus in Wisconsin, is known as the lowest cost healthcare provider in the state.<sup>85</sup> This status was possible through TPS application within ThedaCare's hospitals. Embracing lean principles and waste reduction as well, RASN provides the opportunity for patients to recognize Aspirus as the most efficient and affordable surgical and anesthesia service in the UP.

### System Level Management

Banner Health in Phoenix, Arizona, mastered the development of best practices with the use of system level management throughout their twenty-two hospitals.<sup>5</sup> Senior leaders, chief financial officers, and chief medical officers do not report directly to a CEO at the facilities. Their supervisors consist of corporate leaders within a managing system, who ultimately hold the

accountability and responsibility of the organization. As a result, management incentives are set at a system level, despite many differences in facilities.<sup>5</sup>

It is imperative to capture standardized approaches and evidence-based principles within system level management.<sup>5</sup> This platform allowed Banner Health to efficiently and effectively identify areas for improvement, as well as implement change across the organization. Learning between hospitals is encouraged. Managers share successes and failures across the network. If an error occurs at one facility, the hospital completes a root cause analysis and results are shared with the whole organization.<sup>5</sup>

The development of RASN would increase transparency across the UP hospitals. As part of the Aspirus, Inc hierarchy, the Regional Director of Anesthesia and Surgical Services Lines would be placed at the level of Senior Vice Presidents (Appendix I). This would allow direct communication with Matt Heywood, President/CEO of Aspirus, Inc., ensuring RASN's support of the mission, vision, and values of the organization.

### Standardization

According to the Joint Commission, the fundamental goal of safety can be achieved through standardization, where clinical practice patterns are consistent with scientific-based evidence.<sup>86,87</sup> Anesthesia providers can feel confident with a system and comfortable with available resources.<sup>88,89</sup> Uniformity forces providers to follow a pattern, reducing the need to rely on one's memory. This increases consistency and patient safety.<sup>88</sup> Admission processes and preoperative patient evaluations can be standardized, decreasing delays. Reducing scheduling barriers requires surgical staff to communicate with anesthesia and surgeons, eliminating

wasteful steps and unnecessary testing.<sup>88</sup> According to literature, disregarding standardization is risky practice and increases error among anesthesia providers and staff.<sup>86</sup>

Within healthcare, standardization may be viewed negatively as many believe it decreases one's level of autonomy.<sup>90</sup> The roles of employees are required to change. Employees no longer make decisions or act on their own freewill. They are retrained to operate with a high level of autonomy. Standardization decreases unnecessary steps and simplifies actions, reducing the time needed to perform certain tasks.<sup>90</sup> This makes the process more predictable.<sup>17</sup>

The concept of standardization within RASN is not about creating a surgical manufacturing line. Standardization should be viewed as the creation of infrastructure for the organization, similar to paving roads, erecting telephone poles, and connecting water supply lines. RASN would provide surgical and anesthesia department managers with tools to improve performance, efficiency, and ultimately profits at the CAHs.

Each UP hospital has different standards for preoperative testing. This is an issue RASN could address. Working as a collaborative team, the Director could consult every anesthesia department in the UP, as well as review evidence-based literature. Final decisions, formed through open discussions, would be based on best practice and mutual agreement. The outcome would be standardized preoperative testing, giving patients the same surgical experience at any Aspirus hospital.

### Brand Imaging

Brand imaging is the comprehension of a brand's personality, as perceived by real or potential customers.<sup>91,92</sup> It is formed by direct experience with a brand's theme.<sup>92</sup> More than a

mental picture, the brand image is usually tied to emotions. Conveying the company's mission and vision, brand imaging clearly separates an organization from its competitors.<sup>91</sup>

Successful branding of the surgical experience at the CAHs in the UP is perhaps the most significant result capable with RASN. Aspirus has an urgent need to brand the surgical experience at an Aspirus facility. Hospital systems, such as Beaumont Hospital in Southeastern Michigan, have already accomplished this goal. Functioning with the same mission, vision, and values, a highly-collaborative surgical team attracts more customers. Under RASN, teams at each facility would be trained to decrease waste, increase efficiency, improve utilization, and implement best clinical practices. Patients will notice timely and professional attitudes from engaged staff that are passionate about their organization. RASN would influence the greatest loss within the ORs, excess capacity. Designed to incorporate brand imaging, RASN could lure in highly-skilled providers who are seeking a hospital system that is highly competitive, cutting edge, evidence-based, and focused on delivering the best care possible to patients.

### TPS Implementation

TPS is a people-friendly approach where those who do the work participate in performance improvement.<sup>63</sup> It is focused on continually reducing waste and improving workflows to produce a highly valued service or product.<sup>21,93</sup> This improves workflow by reducing workarounds, waste-related delays, and rework.<sup>93</sup> The results of lean include reduced personnel costs, improved productivity, waste elimination, and enhanced financial performance.<sup>21</sup>



*Why Lean in Aspirus*

With the healthcare industry experiencing fierce competition and patients having freedom to choose where to obtain services, lean implementation can be considered as part of a hospital's growth strategy.<sup>94</sup> Lean healthcare is focused on reducing waste, wait times, and unnecessary processes while building efficiency, quality, and flexibility into organizations. Employees have more time to care for patients instead of performing unnecessary tasks.<sup>94</sup> Most importantly, the overall patient experience is enhanced, thus creating growth opportunities for the hospital.<sup>94</sup>

Lean thinking embraces five key principles, which include:<sup>63</sup>

1. Determining value as seen by the customer
2. Recognizing the value stream or those activities which provide value
3. Eliminating bottlenecks to provide uninterrupted value flow
4. Value is exactly when and where it needs to be as viewed by the customer
5. Pursuing perfection through project improvements

Applying the five key lean concepts within the UP hospitals could be advantageous if implemented strategically and intentionally. With limited resources in rural areas, results such as decreased waste and better efficiency have the ability to directly improve the organizations' bottom line at each facility. Patients will notice improved processes and engaged employees who care about their jobs and the organization. Employees would become loyal to Aspirus, reducing recruitment and training costs. The author of this paper challenges Aspirus, Inc. to study the TPS system, Toyota's proven model of excellence, as the supporting literature *res ipsa loquitur* (speaks for itself). Its lean principles applied with RASN would undoubtedly secure the future of anesthesia and surgical services in the UP for Aspirus.

*RASN's Impact on Patients*

The author of this paper believes RASN would have minimal negative effects on patients. Customers are likely to have a positive surgical experience and return to an Aspirus hospital. With lean application through RASN, employees will be working at a higher level, completing their jobs smarter and with less effort than before. The same level of care will be available at any Aspirus anesthesia or surgical department, and customers will grow to expect RASN's high-quality, prompt service. This emotional connection with patients and their families will create the brand image of the Aspirus' surgical experience.

*The Bottom Line*

Viewing an anesthesia and surgical department through the lens of TPS does not mean patients are transformed into widgets. It is critical to analyze the flow of patients throughout the Aspirus system in order to identify repetitive steps, waste, and bottlenecks. The author of this paper developed the vision of RASN based on her experiences at AGV and AIR, as well as examination of available data from key contacts. Combining knowledge of each facility's daily operations with budget and variance reports, as well as Epic volume reports, metrics were hypothesized. Through RASN, Aspirus could experience over \$1 million in savings at each CAH.

Why RASN includes Anesthesia and Surgery

The author's experience at AGV and AIR suggested that controlling only anesthesia departments across the UP would be creating a system doomed for failure. Surgical schedules must be managed under the same guiding leadership of a regional program in order to ensure surgical efficiency and maximum capacity. If not managed properly, sustainable metrics and cost

savings cannot be experienced by Aspirus. Block changes at each facility will more than likely be required in order to achieve long-term success with RASN.

At AGV, the general surgeons are allowed to work in the OR and perform endoscopies five days a week. Allowing surgeons to choose the surgical schedule has wrecked havoc on staffing models and staff satisfaction. Staff morale and trust with management has declined to the point of routine counseling and corrective actions among previously engaged staff with years of longevity. Through research for this Capstone project, the author of this paper believes the feelings of distrust can be overcome with written scheduling policies. The surgical department manager must learn the art and science of accommodating surgeon schedules while maintaining OR efficiency. Additional support would come from the Director and a physician leader at each facility, who embrace the strategic imperatives of RASN.

#### *The CAH Difference with Surgical Schedules*

Current literature focuses on large surgical departments with multiple ORs.<sup>23,30</sup> In these studies, researchers sought to overcome the main bottleneck of OR availability in the surgical departments by increasing the amount of surgical minutes.<sup>23,30</sup> Effective block scheduling at CAHs, where the amount of surgical minutes is plentiful, is not discussed in research. At two of the hospitals examined in this project, staffing was the major bottleneck. Instead of struggling for surgical time, surgeons fight for anesthesia providers to administer anesthesia, technicians to assist with a procedure, and nurses to prepare their patients in a timely manner for surgery. In Aspirus CAHs, the author discovered and personally experienced, how staff is the most highly revered limited resource, not OR availability.

*Surgical Volume Variations*

Cima and colleagues identified OR volume variations were caused by inadequate OR capacity given to surgeons when planning their operative schedules.<sup>21</sup> A lack of coordination and communication in surgical specialties interfered with appropriate management of OR resources, such as equipment requirements and estimated procedure timeframes. With the application of lean methodology's CI strategies, personnel costs were reduced.<sup>21</sup> Despite an increase in surgical cases, the department significantly decreased the number of nursing and allied health staff required to perform daily operations. Overtime and mandatory late shifts were also reduced for surgical nurses and CRNAs by 30 percent and 50 percent, respectively.<sup>21</sup> Teamwork, communication, and staff satisfaction improved with lean application. Overall, outcomes revealed improved efficiency and resulted in superior financial performance.<sup>21</sup>

Variations in surgical volume are a significant problem in AGV's ORs. One day may have twenty cases, and then a subsequent day might have only two. This greatly reduces efficiency and creates problems for staffing schedules, specifically with vacations and locum planning. A key issue, control over the OR schedule, is left to multiple nurses located in the surgeons' clinics, who assign patients surgery days without approval from the surgical department manager. Lack of communication and understanding about the importance of tighter scheduling has resulted in the surgical department guessing what will be scheduled each day.

Surgeons, anesthesia, and surgical staff often express discontent and frustration directed towards the variation in schedules. Employees feel the heavy burden of completing extra work and being rushed, or significant pressure to cut corners. Caring for large volumes of patients periodically throughout the day can be stressful and overwhelming. Unnecessary bottlenecks are



created, such as insufficient staff, equipment, and OR availability. With a steady flow, staff will feel less overworked and stressed.

#### *Anesthesia Bottlenecks in AGV's Block Scheduling*

The creation of a surgical schedule based on 100 percent blocks or 100 percent first-come, first-served time slots is not feasible.<sup>30</sup> This system leads to daily crisis management as urgent and emergent cases are not accommodated appropriately. AGV already experienced this failure as the surgical schedule implemented in September 2015 was based on 100 percent blocks. Bottlenecks in the anesthesia department were created. Four providers were scheduled every morning at 8:00 AM with four different surgeons. The new schedule did not allow a float provider to cover unplanned services to obstetrics, medical/surgical units, and the emergency department, such as epidurals, intubations, and IV starts. Instead, when an anesthesia service was needed outside of the OR, the surgical cases were delayed until another anesthesia provider was available. Surgeons and patients became upset with waiting. Therefore, an optimal schedule should be developed to service not only urgent and emergent surgical cases, but also other responsibilities of the anesthesia department.<sup>94</sup>

#### *Locum CRNAs are not a Solution*

Locum CRNAs are not a solution for any Aspirus CAH in the UP. Contracted services are extremely costly to the hospitals. Many of the locums employed at AGV and AOH demand \$1,200 per day, eight hour guarantee. When a locum anesthesia provider is hired to cover a specific day, he/she is paid until 3:00 PM regardless of whether anesthesia services are performed or not. Money may be leaving the anesthesia department, without revenue coming in. At AOH, locum providers cost more than an Aspirus employee in that position.

*Anesthesia Quality*

The definition of quality in healthcare from the Institute of Medicine (IOM) demands providers help patients reach their desired health outcomes through current, professional knowledge.<sup>36</sup> QI also embraces exploration of system performance and professional development. Managing quality within an anesthesia department is a complex task.<sup>36</sup> Multiple indices, such as measures and outcomes, are grouped and tracked. Comparisons of actual versus desired performance are examined. One process encourages providers to create a list of performance standards that fit the unique needs of their departments which align with organizational quality initiatives.<sup>36</sup> Results should be measured and examined to determine how well each criterion is met. Benchmarking clinical outcomes to national measures, such as those from the Anesthesia Quality Institute, is another important component of QI.<sup>12</sup> Other anesthesia-related quality concerns are safety and stability of the workforce, such as recruitment, attrition, and satisfaction.<sup>36</sup>

RASN would allow the creation of an Anesthesia QI program between the CAHs, similar in design to those of larger anesthesia departments. This opportunity encourages providers to bring questions and case studies to colleagues, in similar hospital settings, who may have more education or experience in a particular area. Modeled after larger hospitals' QI programs, RASN would seek to stimulate individual growth and competency. This gives Aspirus anesthesia providers the opportunity to become involved in a network of professionals who care about improving patient safety and anesthesia delivery. The team would meet quarterly to discuss statistics, anesthesia morbidity and mortality, and current trends in literature.

*RASN and OR Managers*

Skilled surgical managers know how to handle daily fires based on previous experience.<sup>2</sup> Band-aids are quickly placed on problems without examination of true facts. These managers work on assumptions without exploring possible theories.<sup>2</sup> This type of management is not supportive in TPS.<sup>2</sup> One must be willing to ask questions and explore the root of the problem. A lean manager understands the value of talking to front-line workers and importance of walking the *gemba*, the Japanese word for workplace.<sup>2</sup> Gemba specifically refers to the site where work is accomplished. With lean, decisions are made at the gemba, not board rooms or offices. RASN would assist with this TPS transformation by providing an infrastructure to guide managers' skills and attitudes, while instilling lean thinking.

Supply Chain Management

As one of the most resource intensive areas of the hospital, surgery demands roughly 50 percent of the materials management budget.<sup>24</sup> The large amount of surgical supplies can quickly become mishandled. Materials management leaders usually have minimal healthcare experience and are oblivious to the unique needs of an OR.<sup>24</sup> Hospitals typically do not have accurate baseline inventories of what they own, nor do they have usage data to monitor what they consume.<sup>79</sup> Materials management generally possesses a strong knowledge of what has been purchased, but are usually unable to compare product consumption, on-hand quantities, and purchased volumes. Hospital executives may ask material managers to become directly involved with controlling surgical inventory in hopes of controlling expenses.<sup>24</sup> With knowledge of perioperative services and consumption patterns, supply chain management can significantly contribute to the financial and operational performance of the surgical department.<sup>79</sup>

One of RASN's cost saving measures is to combine anesthesia and surgical supplies among the CAHs. Utilizing the same suppliers and sharing purchases lead to cost savings. For example, endotracheal tube adapters for bronchoscopies are only available in boxes with 100 pieces. Unfortunately, because bronchoscopies are rarely performed, a box will more than likely expire before it is used. The inventory on the shelves is also costly for Aspirus.

A centralized ordering and sharing program through RASN could decrease unnecessary waste. In the example, the UP hospitals could share the cost of the tube adapters, and eliminate expired waste. Over the product's shelf life, the facilities could transfer tube adapters between each hospital as used to prevent another large unnecessary purchase. The hospitals could also save additional money by ordering bulk supplies from the same vendors.

Other areas in which RASN could assist with supply chain management include:

- Practices of inventory management
- Product expiration and recall management
- Standardization of charge capture
- Inventory values and valuation
- Supply costs to patients, cost per case, cost per surgeon
- Surgeon preference card updates

### Barriers to RASN

Multiple organization-wide initiatives are in progress to standardize processes within Aspirus. As the company acquires additional facilities and grows, it is critical to operate the individual entities under one, well-functioning organization. Aspirus clearly values the idea of centralization. RASN is a department merger under existing Aspirus strategies.



Floating anesthesia providers would administer services at facilities in need, without disruption of services to patients or extravagant locum costs to Aspirus hospitals. The program would employ a Director with a passion for data analysis and desire to eliminate waste. The Director would have the obligation to lead change within Aspirus, improving patient experiences, physician relations, staff culture, and the financial status at each hospital.

Changes may be viewed with concern from stakeholders. For example, the recommended change to move AGV from eight hour surgical days to smoother ten hour days, may cause some to believe the ORs would be closed on the fifth day of the week. However, a strong Director with precision communication skills can provide education to the affected parties, ensuring that a highly-talented surgical team is on-call and ready to provide immediate care whenever necessary. Employing only the call team on Fridays minimally impacts the surgeons' or patients' schedules, as this is not a high-demand surgical day, nor often requested by patients. Changes initiated by the Director, such as this example, would be supported with data and evidence-based literature. Overall, RASN can be successful with a proven, successful leader who views barriers as opportunities to build relationships.

### **Limitations of this Capstone Project**

Initially, the author of this paper traveled to each UP facility to discuss the intentions of the Capstone project with hospital leaders. In attendance was a key contact, assigned to gather necessary data for the author. Throughout the project, limitations were identified as the inability to:

- Access necessary information: Surgical managers seem to have limited access to information about the departments. Attempting to understand reports, two managers

manually enter data into Excel spreadsheets for easy interpretation. EPIC, the electronic medical record, does not capture necessary information required to operate a successful surgical department, as outlined in literature. It is wasteful and time consuming to have surgical department managers hand-enter data every month in an attempt to monitor metrics.

- Interpret the author's questions: Many questions the author asked key contacts were not answered due to lack of knowledge. Managers did not know how to answer the author's questions or where to go for the information. Managers had never considered some of the author's questions prior to this Capstone project. Through multiple email communications, some departments within the hospitals appeared to block valuable information from the surgical managers.
- Obtain necessary information: The author of this paper was not allowed access to all the information she wanted to examine, such as the total compensation of permanent anesthesia providers or updated monthly budget and variance reports to monitor the finances of the departments.
- Monitor the departments throughout the Capstone sequence: The author was unable to obtain more than one anesthesia budget and variance report from the three hospitals and only one surgical budget and variance report from two hospitals. As the Capstone process progressed, the author was unable to monitor the departments' current needs; some information contained in this report may be outdated before disseminated to Executive-level management.
- Obtain information in a timely manner: The key contacts for this project are also managers of demanding surgical departments. Working around their responsibilities proved to be difficult, as many of the author's questions required investigation.
- Interpret the budget and variance report accurately: Budget and variance reports force the departments to work in silos. It is impossible to observe patient flow through the system. The budget and variance reports also appear to be created differently from facility to facility. For example, AGV's anesthesia budget and variance report focuses heavily on expenses. AIR's anesthesia budget and variance report does not have any expenses recorded.

- Collect information for financial analysis: Three separate reports were required to determine the cost savings RASN could provide to Aspirus. They included anesthesia and surgical budget and variance reports, and Epic surgical volume reports. Due to limited access to data, the author of this paper was only able to predict savings from two of the three facilities. Averages were used for the other two because of incomplete information.
- Identify anesthesia department supplies and costs: Each hospital struggled with recognizing the most utilized anesthesia-specific supplies and their associated costs; therefore the supply chain research was limited for this Capstone project.

The omission of the UP's fourth hospital, AKH, was another limitation to this Capstone project. Despite positive communication with the facility, the key contact was unable to comply with information requests. Therefore, the facility was excluded from this project and is not included in the final recommendations.

The following are recommendations of this author. Once a Director is chosen to lead RASN, he/she must be provided with adequate time to travel to each facility, collecting data and connecting with people who possess the necessary information. Processes should be observed, and staff and patients interviewed, to determine the individual needs at all Aspirus CAHs.

## **Conclusion**

Areas supported through the research of this Capstone project for Aspirus to consider when implementing RASN include:

- Anesthesia and Surgical Personnel Management
- Standardization
- Workflow Optimization
- Fiscal Management and Monitoring

- Supply Chain Management
- Quality Improvement
- Brand Imaging
- Efficiency

To optimize value, Aspirus must have transparent and accountable anesthesia and surgical departments directly responsible for leading efficiency and productivity within perioperative services. The author of this paper found transparency was not a common trait among the UP hospitals. It was challenging to obtain current information due to delayed Budget and Variance reports, as well as differences of interpretation, and the inability or inconvenience to collect or track pertinent data. Many of the questions posed to key contacts were based on current literature's requirements for managers to operate efficient anesthesia and surgical departments. A large amount of questions regarding staffing, supplies, and financial status of the departments were unable to be answered by surgical management and resources. The author of this paper questions how Aspirus will experience maximum return from the most highly profitable departments when evidence-based metrics are not monitored. RASN may serve to remedy this.

Research recognizes high-performing anesthesia and surgical departments use data to validate their financial, operational, and clinical decisions and service deliveries. The small amount of data evaluated for this Capstone project identified at least \$4 million in savings through RASN's lean methodologies among the UP's anesthesia and surgical departments. While each facility is capable of creating change independently through intensive corporate coaching, the author strongly believes continued success will not be experienced without sustained guidance of a regionalized program, like RASN, and a talented Director. It is the expert



opinion of this author to pursue the program and begin the implementation of RASN as soon as possible, branding the surgical experience and applying lean thinking in Aspirus.

## **Appendices**

### Appendix A: Example Job Description

Reference: Corporate Director of Anesthesia for DCH Health System

#### **JOB SPECIFICATIONS**

*Specific background/experiences and skills/accomplishments that appear to be the most important for success in the position.*

- Career track of increasingly responsible and complex anesthesia management roles required. Ideal candidate is driven and motivated and possesses a stellar record of leadership, unquestioned integrity, high energy, vision, and demonstrated leadership and administrative ability. The successful candidate will possess a diversity of experiences along with the qualities to lead anesthesia services delivered by multiple environments on behalf of the healthcare enterprise.
- Leadership record that demonstrates the ability to support and clearly articulate and demonstrate the mission, vision and values of DCH, with the proven skill to participate in the development of a strategic plan and operationalize the objectives of the plan.
- Proven skill to collaborate with leadership to advance quality strategies, ensure a professional collaborative work environment, and facilitate timeliness of services. Record demonstrates the promotion of positive interpersonal relationships with other departmental leaders and end users of anesthesia services.
- Management skill to oversee and orchestrate, evaluate, and ensure compliance for Managers, CRNA's, Anesthesia Technicians, Material Management clerk, Data Specialist, and Administrative Coordinator. Provides anesthesia care, under the medical direction of an anesthesiologist, to patients of all age groups (neonate, pediatric, adolescence, adult, geriatric) requiring anesthesia services.
- Possesses a record for implementing strategic and operational initiatives that achieve measurable goals targets. Reputation for building a culture of accountability and performance. Record of service as an excellent role model of professional standards and practice.
- Skill to collaborate with leadership to advance quality strategies, ensure professional work environment, facilitates timeliness of services and enhances the patient experience. Promotes positive interpersonal relationships.
- Experience in assuring compliance with various quality standards and regulatory agency requirements within the Medical Center (TJC Credentialing, Standards of Advanced Nursing Practice, Standards for Nurse Anesthesia Practice, CRNA Scope of Practice, Structural Indicators, etc.)
- Experience in developing and monitoring operational and capital budget for anesthesia departments including coordinating with appropriate interdisciplinary team members for purchasing and servicing of anesthesia supplies and assuring financial reports are submitted in compliance with guidelines and departmental productivity standards.
- A change agent with performance improvement / change leadership skills involving demonstrated ability to move culture as well as processes/programs. Possesses a management style and philosophy based on empowering, leading and inspiring rather than on hierarchy and directives.
- Leadership ability to identify best practices and quality initiatives with the influence to gain "buy in" and achieve implementation across the enterprise. Record of success in attracting, recruiting, mentoring, retaining and growing managers and staff through the development and continuing education of staff members.
- Proven team-building expertise. Develops strategic relationships to identify needs and critical success factors and to strengthen the overall effectiveness of the organization. Ability to build commitment and drive for results, establishing a culture of excellence.
- Ability to assess operations, financials, and personnel. Capacity to orchestrate, organize, and streamline operations across the enterprise to achieve financial, service, and market share objectives. Thorough knowledge of all phases of the budget process with the financial management skills to collect, monitor, and interpret data to assess and improve operations performance to meet or exceed benchmarks.
- Experience effectively representing healthcare organizations to the community to enhance "good will"

and advance positive community relations.

- Expertise, working knowledge, leadership experience and implementation of strategies in quality-related disciplines. Leadership experience to collaborate with facility leaders in the development and implementation of a strategic plan for quality and performance improvement processes to facilitate enhanced outcomes within a safe environment of care.
- Graduation from a School of Nurse Anesthesia and possess a current State of Alabama RN and CRNA license or has the ability to attain such. Current National Board of Certification and Recertification for Nurse Anesthetist license. ACLS, BLS and PALS provider.

## PEOPLE SPECIFICATIONS

*Those human traits and abilities which appear to be most important for the success of this position.*

- Creates positive relationships with patients/families, coworkers, colleagues. A willing advocate on behalf of staff and leaders; a protector of positive morale and a staunch promoter for overall excellence in organizational performance.
- A proactive initiator with visionary and values-directed leadership. A self-directed, self-starter with the initiative, confidence and charisma to encourage and empower a highly qualified team.
- A creative innovator and outside-the-box strategic thinker. An energetic individual who makes the most of every moment.
- Enthusiasm and energy to stimulate and engage. A track record of building and nurturing productive working relationships to accomplish strategic and operational goals. Able to quickly establish and maintain rapport and demonstrate professional credibility and value with staff and other leaders inside and outside the health system.
- Demonstrated ability to manage multiple independent projects simultaneously.
- Ability to gain consensus and "buy in". Politically astute, not political.
- Smart and articulate, possessing strong consultative, presentation and communication skills, with proven excellence in written communications.
- An approachable, engaging team-builder and collaborator with excellent interpersonal and relationship building skills. Leadership style to nurture and serve as a resource to internal constituents.
- A change agent with initiative and independence, with ability to envision, develop strategies, synergies and collaborations to facilitate positive change and growth balanced with reverence and respect for organizational tradition and history. Able to appropriately challenge decisions and decision-makers toward achieving organizational objectives.
- An intelligent strategic thinker with broad, long-term vision. Creative, flexible, energetic, adaptive, and not easily frustrated. Able to facilitate multiple competing priorities and divergent viewpoints.
- Excellent follow through skills with record for initiating action and responding to constituents in a timely way. Propensity to go above and beyond, taking action that goes beyond job requirements in order to achieve organizational objectives.
- An able and willing ambassador for the organization. Fosters/reinforces collaborative and collegial relationships and work environment. Communicates consistently and openly with Administration, Management and Staff. Tailors his/her approach to add value in a variety of environments.
- Sensitive to, understands and encourages cultural diversity throughout the organization, and the community.



Appendix B: Original Email of Capstone Proposal Questions**Examination of locum versus permanent staff expenditures**

- Locum anesthesia base costs from the last 2 years (separate out housing, travel, food costs). EXCLUDE call pay.
- How many locums does your hospital have credentialed?
- Do you pay your locums differently?
  - Do they have separate contracts?
  - If yes, what is the lowest rate?
  - What is the highest rate?
  - Would you feel comfortable providing all the rates so I can get an average? Or you can tell me what the average is. However, still provide the lowest and highest as requested above.
- Permanent anesthesia staff compensation for the last 2 years
- How many permanent staff does your hospital have credentialed?
- Do you have full time or part time permanent staff? What FTEs?
- Benefits/perks and those associated costs for both locum and permanent staff (example: housing, food, sick days, medical benefits, CME days/monies, etc.) – if multiple locums have different benefits please make sure to list how many locums have what benefit when these are listed out so I know how many locums receive those benefits)
- Do you pay malpractice for locums?
  - If yes, how much and what is the coverage?
- What does it cost your hospital to initially credential anesthesia providers?
  - Is the cost different for locums?
  - What does it cost your hospital to maintain credentialing for a locum anesthesia provider every year?
  - What does it cost your hospital to maintain credentialing for a permanent anesthesia provider every year?
- Number of total vacation weeks for anesthesia staff
- Number of total days covered for vacations in the last 2 years
  - Do you cover vacation days with locums regardless of number of scheduled cases or surgeon vacations, etc?

- How do you determine what days are to be covered?
  - What do you do if you cannot find a locum to provide coverage? Also, how often (how many days) has this happened?
  - Have you ever had to deny vacation requests because of staffing concerns? If yes, how often does this happen?
- Number of days locums have been cancelled for various reasons
  - Do your locums charge you money if the cancellation is late notice? If yes, how much do you pay to cancel them?
  - Does this happen often?
  - What are the reasons they are cancelled?
- Where do you find locum anesthesia providers?
  - Have you used an agency in the past 2 years?
  - If yes, were there extra agency fees? What were they?
- Have you had problems with recruitment of anesthesia providers?
  - How many positions have you had to fill in the last 2 years?
  - Reasons for turnover?
  - Reasons for problems with recruitment?
- Do your locums cover after hour surgeries?
  - Do you provide extra compensation? If yes, what? Is it considered call pay?
- Do your locums cover call?
  - Do you provide extra compensation? If yes, what?
  - What was the call pay you paid locums in the last 2 years?
- Does your permanent staff cover call and after hour procedures?
  - If yes, do they get call pay? What is call pay?
  - What is the percentage and number of after hour surgeries you perform?
- Any other staffing issues?

**OR Stats**

- How many ORs and endoscopy rooms do you have?
- Number of surgical cases/year for last 2 years
- Number of days surgery department is open/year
- Number of anesthesia hours worked per year for the last 2 years

- Expected growth plans/rates in the future for each surgical department/hospital
  - What other service lines are you anticipating?
- What is the average length of day your ORs are open?
  - When is considered after hours?
- What are the average work days for your anesthesia providers?
- What types of surgeries do you perform?
  - How many surgeons of each specialty do you perform?
  - What are the top 3 procedure types you perform (example: general, GYN, Urology, etc.)?
- Do you cover OB call?
- Does your anesthesia department provide pain services (such as epidural steroid injections)?
- What other areas in the hospital does your anesthesia department service (example: ER, OB, CT scan, etc.)?
  - Are these areas covered by the on-call anesthesia provider?
- Any other OR stats you think will be helpful?

#### **Anesthesia-specific Supplies**

- Pattern of re-ordering anesthesia-specific supplies
- What are your 25 most frequently used anesthesia-related supplies (excluding commonly used items such as syringes, IV tubing, etc.)
- Vendor and cost for the most used supplies listed in the bullet point above
- How often are specialty items ordered?
- What type of anesthesia machines do you have?
- What anesthetic gases do you have?
- Are there large anesthesia-related purchases in the next year for your department? If yes, what is it?
- Does your anesthesia department have a budget?
  - What is it?
  - How much does the department spend per fiscal year on specialty items?
  - In the last 2 years, has the department gone over budget? If yes, why?

- How much has the hospital had to subsidize the department if it has gone over budget?

**Anesthesia and anesthesia-related policies at each facility**

- Please email individual policies and procedures to Christa

**Quality Improvement data from each facility**

- What system is in place currently?
- Are adverse anesthesia reactions tracked?
- Are adverse anesthesia reactions reviewed? If yes, how?
- Does your anesthesia department have staff meetings?
  - If yes, how often?
- Are cases ever discussed among your practitioners?

**Billing information from each hospital, including coding modifiers used**

- What is the structure of your anesthesia billing system?
- What modifiers are used?

**Anesthesia Department**

- Describe the structure of your anesthesia department
- What are their strengths?
- What are their weaknesses?
- What areas would you like to see improved?

Any other information you think would be helpful would be greatly appreciated!!!!



Appendix C: IRB Determination of "Not Regulated" Status

Flint Institutional Review Board • 520 French Hall, 303 E. Kearsley St, Flint, MI 48502 • phone: (517) 762-3333 • fax: (517) 593-0526 • [research@umflint.edu](mailto:research@umflint.edu)

**To:** Christa Klyder

**From:**

Marianne

McGrath

**Cc:**

Jane

Motz

Christa

Klyder

Gregory

Laurence

**Subject:** Notice of Determination of "Not Regulated" Status for [ HUM00115206 ]

**SUBMISSION INFORMATION:**

Title: Regional Anesthesia and Surgical Network

Full Study Title (if applicable): Through the Lens of the Toyota Production System: Recommendation for the Implementation of a Regional Anesthesia and Surgical Network in Michigan's Upper Peninsula Critical Access Hospitals owned by Aspirus, Inc.

Study eResearch ID: [HUM00115206](#)

Date of this Notification from IRB: 4/22/2016

Date of IRB Not Regulated Determination: 4/22/2016

**IRB NOT REGULATED STATUS:**

Category

Outcome Letter Text

**Research on  
Organizations**

Based on the information provided, IRB approval is not required for this project, as it does not include identifiable private information about individual members, employees or staff of the organization that is the subject of the research.

**Other**

A handwritten signature in blue ink, appearing to read "M. McGrath". The signature is stylized with a large loop at the end.

**Marianne McGrath**  
Chair, IRB Flint

Appendix D: AOH's Response to Christa Klyder Capstone Proposal Questions

*Survey returned July 2, 2015.*

*Completed Answers are highlighted with red font.*

**Examination of locum versus permanent staff expenditures**

- Locum anesthesia base costs from the last 2 years (separate out housing, travel, food costs). EXCLUDE call pay. **Services are \$1,200.00/day and 0.575/ mile. Average mileage is \$100.00-115.00 per day.**
- How many locums does your hospital have credentialed? **10 total**
- Do you pay your locums differently?
  - Do they have separate contracts? **Just 2 separate contracts**
  - If yes, what is the lowest rate? **\$1,200.00/ day plus mileage**
  - What is the highest rate? **\$1,200.00/ day plus mileage**
  - Would you feel comfortable providing all the rates so I can get an average? Or you can tell me what the average is. However, still provide the lowest and highest as requested above. **See above for details**
- Permanent anesthesia staff compensation for the last 2 years. **None**
- How many permanent staff does your hospital have credentialed? **None**
- Do you have full time or part time permanent staff? What FTEs? **NA**
- Benefits/perks and those associated costs for both locum and permanent staff (example: housing, food, sick days, medical benefits, CME days/monies, etc.) – if multiple locums have different benefits please make sure to list how many locums have what benefit when these are listed out so I know how many locums receive those benefits)**NA**
- Do you pay malpractice for locums? **yes**
  - If yes, how much and what is the coverage? **1 million/3 million (Locton- new broker 3/3/2015. We have Covery's insurance and for CRNA'S we paid \$147.00/year for coverage.**
- What does it cost your hospital to initially credential anesthesia providers? **\$50.00 initial each then \$45.00 per person every 2 years.**
  - Is the cost different for locums? **We use all Locums**
  - What does it cost your hospital to maintain credentialing for a locum anesthesia provider every year? **Same as above.**

- What does it cost your hospital to maintain credentialing for a permanent anesthesia provider every year? **NA**
- Number of total vacation weeks for anesthesia staff **NA**
- Number of total days covered for vacations in the last 2 years **We had to cancel Surgical cases twice in the past 2 years related to no CRNA coverage due to later new day cases if I remember correctly, about 1-2 weeks out.**
  - Do you cover vacation days with locums regardless of number of scheduled cases or surgeon vacations, etc? **NA**
  - How do you determine what days are to be covered? **We use a pretty set schedule.. GI scopes are about 2-3 Friday's per month and Orthopedic procedures and the 3<sup>rd</sup> week of each month on Tuesday and Wednesday and sometimes he does minor procedures on Thursday that do not usually require Anesthesia.**
- What do you do if you cannot find a locum to provide coverage? Also, how often (how many days) has this happened? **We had to cancel surgical cases twice in the past 2 years related to no CRNA coverage due to later new day cases if I remember correctly, about 1-2 weeks out.**
  - 
  - Have you ever had to deny vacation requests because of staffing concerns? If yes, how often does this happen? **NA**
- Number of days locums have been cancelled for various reasons
  - Do your locums charge you money if the cancellation is late notice? If yes, how much do you pay to cancel them? **\$1,200.00. We have to notify them 7 days before the date of surgery.**
  - Does this happen often? **No. It has happened 2 times in the past 2 years.**
  - What are the reasons they are cancelled? **No ortho schedule in a timely matter.**
- Where do you find locum anesthesia providers? **NA**
  - Have you used an agency in the past 2 years?
  - If yes, were there extra agency fees? What were they?
- Have you had problems with recruitment of anesthesia providers?
  - How many positions have you had to fill in the last 2 years?
  - Reasons for turnover?



- Reasons for problems with recruitment?
- Do your locums cover after hour surgeries? **Only if they are here for scheduled cases that run late. Occasional add ons.**
  - Do you provide extra compensation? If yes, what? Is it considered call pay?
- Do your locums cover call? **No**
  - Do you provide extra compensation? If yes, what?
  - What was the call pay you paid locums in the last 2 years? **Zero; I did have to pay 2 days of \$1.200.00/day for non-cancelling before the 7 day deadline.**
- Does your permanent staff cover call and after hour procedures? **NA**
  - If yes, do they get call pay? What is call pay?
  - What is the percentage and number of after hour surgeries you perform? **None**
- Any other staffing issues? **Just not cancelling CRNA at least 7 days in advance.**

#### OR Stats

- How many ORs and endoscopy rooms do you have? **1 OR suite total. All procedures are done in this room**
- Number of surgical cases/year for last 2 years **2013-2014 had 339 cases**
- Number of day's surgery department is open/year **It varies. 2-3 days per month Ortho; Scopes average 2 days per month.**
- Number of anesthesia hours worked per year for the last 2 years **Calendar year 2013- approx. 368 hours; Calendar year 2014-approx. 264 hours; Calendar year 2015- approx. 136 hours in the past 6 months.**
- Expected growth plans/rates in the future for each surgical department/hospital
  - What other service lines are you anticipating?
- What is the average length of day your ORs are open? **7 hours**
  - When is considered after hours?
- What are the average work days for your anesthesia providers? **6 hours**
- What types of surgeries do you perform?
  - How many surgeons of each specialty do you perform? **1 Orthopedic, 2 Gastro/general**
  - What are the top 3 procedure types you perform (example: general, GYN, Urology, etc.)? **Gastroenterology, Orthopedic, general**



- Do you cover OB call? **No**
- Does your anesthesia department provide pain services (such as epidural steroid injections)? **No**
- What other areas in the hospital does your anesthesia department service (example: ER, OB, CT scan, etc.)? **None**
  - Are these areas covered by the on-call anesthesia provider? **NA**
- Any other OR stats you think will be helpful? **No**

### Anesthesia-specific Supplies

- Pattern of re-ordering anesthesia-specific supplies. **Inventory checked on a weekly basis and reordered as necessary**
- What are your 25 most frequently used anesthesia-related supplies (excluding commonly used items such as syringes, IV tubing, etc.) **Stimuplex A insulated needle, 348/CS- contiplex Tuphy Continvous Nerve Block, Soda-sorb, \$511.63/CS- O2/CO2 nasla Filter line, Microbore Exrtension set-74inches, \$8.06 each – LMA's, \$67.16/CS- Anesthesia Circuits, \$17.73 each – Spinal Tray, Laryngoscope blades, \$1.23 each – Oxygen masks, Endotracheal tubes**
- Vendor and cost for the most used supplies listed in the bullet point above
- How often are specialty items ordered? **Every 2 – 3 months**
- What type of anesthesia machines do you have? **Narkomed**
- What anesthetic gases do you have? **Seroflurane, Isoflurane, Desflurane**
- Are there large anesthesia-related purchases in the next year for your department? If yes, what is it? **No**
- Does your anesthesia department have a budget? **Yes**
  - What is it? **166 in ENUFF budget advisor.**
  - How much does the department spend per fiscal year on specialty items?
  - In the last 2 years, has the department gone over budget? If yes, why? **No, not at all**
  - How much has the hospital had to subsidize the department if it has gone over budget? **NA**

### Anesthesia and anesthesia-related policies at each facility

- Please email individual policies and procedures to Christa Completed this on June 29<sup>th</sup>. 2015

#### **Quality Improvement data from each facility**

- What system is in place currently? Data is entered into OPPE(ongoing professional practice evaluation)
- Are adverse anesthesia reactions tracked? In Health care safety zone and added to OPPE recently.
- Are adverse anesthesia reactions reviewed? If yes, how? Follow up on health care safety zone event. We have done a RCA( root, cause, analysis) Peer review if warranted or needed
- Does your anesthesia department have staff meetings? No, N/A
  - If yes, how often?
- Are cases ever discussed among your practitioners? If needed AOH will discuss cases with CRNA

#### **Billing information from each hospital, including coding modifiers used**

- What is the structure of your anesthesia billing system? They send us an invoice per their contract.
- What modifiers are used?

#### **Anesthesia Department**

- Describe the structure of your anesthesia department. Our Anesthesia department is somewhat Autonomous in nature however work very well with the OR team and Management.
- What are their strengths? They are a fantastic crew and willing to work with all of us at AOH.
- What are their weaknesses? I would like to see CRNA's on EPIC for documenting and Billing purposes.
- What areas would you like to see improved?

Appendix E: AIR's Response to Christa Klyder Capstone Proposal Questions

*Survey returned August 9, 2015.*

*Completed Answers are highlighted with red font.*

**Examination of locum versus permanent staff expenditures**

- Locum anesthesia base costs from the last 2 years (separate out housing, travel, food costs). EXCLUDE call pay.
- How many locums does your hospital have credentialed? **We have one.**
- Do you pay your locums differently?
  - Do they have separate contracts? **Yes, individual contracts.**

If yes, what is the lowest rate?

- What is the highest rate?
- Would you feel comfortable providing all the rates so I can get an average? Or you can tell me what the average is. However, still provide the lowest and highest as requested above.
- Permanent anesthesia staff compensation for the last 2 years
- How many permanent staff does your hospital have credentialed? **We have 2 permanent staff -1 Anesthesiologist, 1 CRNA**
- Do you have full time or part time permanent staff? What FTEs?**Both work part time.**
- Benefits/perks and those associated costs for both locum and permanent staff (example: housing, food, sick days, medical benefits, CME days/monies, etc.) – if multiple locums have different benefits please make sure to list how many locums have what benefit when these are listed out so I know how many locums receive those benefits)
- Do you pay malpractice for locums?
  - If yes, how much and what is the coverage?
- What does it cost your hospital to initially credential anesthesia providers?
  - Is the cost different for locums?
  - What does it cost your hospital to maintain credentialing for a locum anesthesia provider every year?
  - What does it cost your hospital to maintain credentialing for a permanent anesthesia provider every year?
- Number of total vacation weeks for anesthesia staff
- Number of total days covered for vacations in the last 2 years
  - Do you cover vacation days with locums regardless of number of scheduled cases or surgeon vacations, etc?



- How do you determine what days are to be covered? **The regular staff make a schedule between them both and cover some days with locum tenens staff.**
- What do you do if you cannot find a locum to provide coverage? Also, how often (how many days) has this happened? **We have not had any days not covered.**
- Have you ever had to deny vacation requests because of staffing concerns? If yes, how often does this happen? **This has not been a problem**
- Number of days locums have been cancelled for various reasons
  - Do your locums charge you money if the cancellation is late notice? If yes, how much do you pay to cancel them? **Our locums charges the same rate after being scheduled, whether working or not.**
  - Does this happen often? **Once in 3 years.**
  - What are the reasons they are cancelled? **Case cancellation**
- Where do you find locum anesthesia providers? **Personal contact**
  - Have you used an agency in the past 2 years? **No**
  - If yes, were there extra agency fees? What were they? **N/A**
- Have you had problems with recruitment of anesthesia providers? **We have not had vacancies**
  - How many positions have you had to fill in the last 2 years? **None**
  - Reasons for turnover? **N/A**
  - Reasons for problems with recruitment? **N/A**
- Do your locums cover after hour surgeries? **Yes**
  - Do you provide extra compensation? If yes, what? Is it considered call pay? **Per contract, when taking call, the daily rate is higher.**
- Do your locums cover call? **Yes**
  - Do you provide extra compensation? If yes, what? **Higher daily rate for call**
  - What was the call pay you paid locums in the last 2 years? **Minimal, I believe about 7 - 10 days.**
- Does your permanent staff cover call and after hour procedures? **Yes**
  - If yes, do they get call pay? What is call pay? **They take call when they are working - typically 1 or 2 weeks in a row. Pay is figured in.**
  - What is the percentage and number of after hour surgeries you perform? **I will have to supply you with more detail on this data**
- Any other staffing issues? **No**

#### OR Stats

- How many ORs and endoscopy rooms do you have? **2 ORs, 1 Endo suite**
- Number of surgical cases/year for last 2 years **2012-1003, 2013-840, 2014-726, 2015 thus far- 446**



- Number of days surgery department is open/year - 254
- Number of anesthesia hours worked per year for the last 2 years unknown, there is no way to extract this data.
- Expected growth plans/rates in the future for each surgical department/hospital
  - What other service lines are you anticipating? We are anticipating adding Ophthalmology this next year. We have been looking for a urologist as well.
- What is the average length of day your ORs are open? 6 hours
  - When is considered after hours? After 3:30 p.m.
- What are the average work days for your anesthesia providers? - 5-6 hours
- What types of surgeries do you perform? General, orthopedic, ENT, podiatric
  - How many surgeons of each speciality do you perform? I think this sentence could be either surgeons or surgeries. I am not sure what you intended. 1 ortho surgeon, 2 general surgeons, 1 otolaryngologist, 1 podiatrist.
  - What are the top 3 procedure types you perform (example: general, GYN, Urology, etc.)? Flexible Endoscopy, General, Orthopedic, ENT, Podiatry
- Do you cover OB call? No
- Does your anesthesia department provide pain services (such as epidural steroid injections)? No
- What other areas in the hospital does your anesthesia department service (example: ER, OB, CT scan, etc.)? ED, IV access at times in ED and Med/Surg/ICU
  - Are these areas covered by the on-call anesthesia provider? Yes
- Any other OR stats you think will be helpful? Not really

### Anesthesia-specific Supplies

- Pattern of re-ordering anesthesia-specific supplies - weekly inventory and order
- What are your 25 most frequently used anesthesia-related supplies (excluding commonly used items such as syringes, IV tubing, etc.) - breathing circuits, et tubes, oral airways, of course, medications
- Vendor and cost for the most used supplies listed in the bullet point above
- How often are specialty items ordered?
- What type of anesthesia machines do you have? Narkomed
- What anesthetic gases do you have? Desflurane, Sevoflurane
- Are there large anesthesia-related purchases in the next year for your department? If yes, what is it? Yes, anesthesia machines x2.
- Does your anesthesia department have a budget?
  - What is it?

- How much does the department spend per fiscal year on specialty items?
- In the last 2 years, has the department gone over budget? If yes, why?
- How much has the hospital had to subsidize the department if it has gone over budget?

**Anesthesia and anesthesia-related policies at each facility**

- Please email individual policies and procedures to Christa

**Quality Improvement data from each facility**

- What system is in place currently? - **QA form on each anesthesia patient**
- Are adverse anesthesia reactions tracked? **Yes**
- Are adverse anesthesia reactions reviewed? If yes, how? **Yes, quarterly Surgery Committee meeting, Peer Review**
- Does your anesthesia department have staff meetings? **Yes, quarterly Surgery Committee meeting**
  - If yes, how often? **Quarterly**
- Are cases ever discussed among your practitioners? **Yes, at the quarterly meetings and as needed.**

**Billing information from each hospital, including coding modifiers used**

- What is the structure of your anesthesia billing system?
- What modifiers are used?

**Anesthesia Department**

- Describe the structure of your anesthesia department – **1 Anesthesiologist who oversees policy and practice. 1 CRNA who works opposite Anesthesiologist hours, unless we are running 2 rooms, which is once a month or so.**
- What are their strengths? **Both do well in emergencies and with general anesthesia and moderate sedation. The CRNA will do spinals occasionally. Both will occasionally do Bier Blocks.**
- What are their weaknesses? **Not much is done in the way of regional anesthesia**
- What areas would you like to see improved? **Would like to see more regional anesthesia for our patients when appropriate**

Appendix F: AGV's Response: Christa Klyder Capstone Proposal Questions

*Survey returned September 10, 2015.  
Answers completed are highlighted with red font.*

**Examination of locum versus permanent staff expenditures**

- How many locums does your hospital have credentialed? **Ten**
- Do you pay your locums differently? **Yes**
  - Do they have separate contracts? **Yes**
  - If yes, what is the lowest rate? **\$125/hr**
  - What is the highest rate? **\$150/hr**
  - Would you feel comfortable providing all the rates so I can get an average? Or you can tell me what the average is. However, still provide the lowest and highest as requested above. **Average- \$140/hr**
- Permanent anesthesia staff compensation for the last 2 years
- How many permanent staff does your hospital have credentialed? **Four**
- Benefits/perks and those associated costs for both locum and permanent staff (example: housing, food, sick days, medical benefits, CME days/monies, etc.) – if multiple locums have different benefits please make sure to list how many locums have what benefit when these are listed out so I know how many locums receive those benefits) **Reimbursed mileage at standard IRS rate and meals at rate of \$35.00/day. Reimbursed reasonable lodging expenses.**
- Do you pay malpractice for locums? **Yes**
  - If yes, how much and what is the coverage? **Minimum \$1,00,000 for each occurrence and \$3,000,000 for all occurrences in any one policy year**
- What does it cost your hospital to initially credential anesthesia providers?
  - Is the cost different for locums?
  - What does it cost your hospital to maintain credentialing for a locum anesthesia provider every year?
  - What does it cost your hospital to maintain credentialing for a permanent anesthesia provider every year?
- Number of total vacation weeks for anesthesia staff
- Number of total days covered for vacations in the last 2 years



- Do you cover vacation days with locums regardless of number of scheduled cases or surgeon vacations, etc? **No**
- How do you determine what days are to be covered? **Pt census**
- What do you do if you cannot find a locum to provide coverage? Also, how often (how many days) has this happened? **Reschedule cases, stagger surgeon start times**
- Have you ever had to deny vacation requests because of staffing concerns? If yes, how often does this happen?
- Number of days locums have been cancelled for various reasons
  - Do your locums charge you money if the cancellation is late notice? If yes, how much do you pay to cancel them? **Yes**
  - Does this happen often? **No**
  - What are the reasons they are cancelled? **Department low census**
- Where do you find locum anesthesia providers?
  - Have you used an agency in the past 2 years? **Yes**
  - If yes, were there extra agency fees? What were they?
- Have you had problems with recruitment of anesthesia providers? **yes**
  - How many positions have you had to fill in the last 2 years? **Two**
  - Reasons for turnover? **Additional CRNA position created**
  - Reasons for problems with recruitment? **Geography**
- Do your locums cover after hour surgeries? **Yes**
  - Do you provide extra compensation? **Yes** If yes, what? Is it considered call pay? **\$225 per hour/ minimum 2 hours**
- Do your locums cover call? **Yes**
  - Do you provide extra compensation? **Yes** If yes, what? **Hourly call rate**
  - What was the call pay you paid locums in the last 2 years?
- Does your permanent staff cover call and after hour procedures? **Yes**
  - If yes, do they get call pay? **Yes** What is call pay? **25-45 per hour for call coverage**
  - What is the percentage and number of after hour surgeries you perform?
- Any other staffing issues?



**OR Stats**

- How many ORs and endoscopy rooms do you have? **Three OR's, one endoscopy**
- Number of surgical cases/year for last 2 years **7/1/2013-6/30/2014 2630**
- **7/1/2014-6/30/2015 2484**
- Number of days surgery department is open/year **253**
- Number of anesthesia hours worked per year for the last 2 years
- Expected growth plans/rates in the future for each surgical department/hospital
  - What other service lines are you anticipating?
- What is the average length of day your ORs are open?
  - When is considered after hours? **After 1530**
- What are the average work days for your anesthesia providers?
- What types of surgeries do you perform? **General, endoscopy, ophthalmology, orthopedics, OB/Gynecology, ENT, and podiatry**
  - How many surgeons of each specialty do you perform? **General/endoscopy-2, Ophthalmology- 2, Orthopedics- 3, OB-3, Gynecology-1, ENT-1, Podiatry-1**
  - What are the top 3 procedure types you perform (example: general, GYN, Urology, etc.)? **general, endoscopy, ophthalmology**
- Any other OR stats you think will be helpful?

**Anesthesia-specific Supplies**

- Pattern of re-ordering anesthesia-specific supplies **Purchasing department orders supplies**
- What are your 25 most frequently used anesthesia-related supplies (excluding commonly used items such as syringes, IV tubing, etc.)**14 fr stylet, adult anesthesia mask, anesthesia circuit, endotracheal tubes, LMA's, esophageal temperature sensor, glide-scope blade, eye shield, oral airways, nasal airways, epidural trays, anesthesia set universal?, spinal tray, cO2**
- Vendor and cost for the most used supplies listed in the bullet point above **Medline**
- **Stylet-\$2.08, Adult anesthesia mask- \$ 1.18, anesthesia circuit- \$6.43, endotracheal tube- \$1.59, LMA \$7.44, esophageal temperature sensor- \$2.29, glide-scope blade- \$16.00, eye shield- \$ 5.10, oral airway- \$0.39, nasal airway- \$3.40, epidural tray- \$ 21.02, anesthesia set universal- \$0.40 , spinal tray \$ 14.00, cO2- \$18.00**
- How often are specialty items ordered? **As needed**

- What type of anesthesia machines do you have?
- What anesthetic gases do you have?
- Are there large anesthesia-related purchases in the next year for your department? If yes, what is it? **No**
- Does your anesthesia department have a budget? **Yes**
  - What is it? **Total operating expenses- \$1,246,630, patient revenue- \$585,367, operating expenses- \$272,452, salaries- \$809,438**
  - How much does the department spend per fiscal year on specialty items?
  - In the last 2 years, has the department gone over budget? If yes, why? **Yes, locum coverage**
  - How much has the hospital had to subsidize the department if it has gone over budget?

**Quality Improvement data from each facility**

- What system is in place currently?
- Are adverse anesthesia reactions tracked?
- Are adverse anesthesia reactions reviewed? If yes, how?
- Does your anesthesia department have staff meetings?
  - If yes, how often?
- Are cases ever discussed among your practitioners?

**Billing information from each hospital, including coding modifiers used**

- What is the structure of your anesthesia billing system?
- What modifiers are used?

**Anesthesia Department**

- Describe the structure of your anesthesia department
- What are their strengths?
- What are their weaknesses?
- What areas would you like to see improved?

Appendix G: Example of Follow-up Email

*Answers are in red font.*

*Questions returned to the author on August 4, 2015.*

Hi \_\_\_\_\_,

Here are a few questions I have for you from the information I received:


1. Do \_\_\_\_\_ CRNAs work under his contract? **Yes**
2. Can you please send me the total amount paid for locums for the last 2 years? I could multiply it based on the hours you gave me, but I do not know what hours were after the 8 hours and when \_\_\_\_\_ worked vs. \_\_\_\_\_ because their rates are different. If you could please send that exact figure for 2013 and 2014 (and current 2015 to date) that would be helpful. If you could give me the total salary amount and separate amounts for travel/gas/food/housing, that would be even better. But, I will take what you have. **Please see attach form.**
3. Who do you book first (Jerry Hill vs. Chris) and why? Is the contract with Jerry Hill new or did you just sign on with him (I see it is dated 2015)? **We use \_\_\_\_\_'s group first. If no one is available then we use \_\_\_\_\_. Yes \_\_\_\_\_ just got a new contract with us as he was an AOH employee.**
4. All 10 locums are credentialed? So you pay \$450 per year to maintain this? (\$45 x 10 locums) **\$45.00 for newly credentialed contractors and every 2 years thereafter each one costs \$45.00.**
5. Which of the policies you sent me are classified under the Anesthesia Department or are they all just under surgery? Does anyone from anesthesia ever read them or approve them? **They are all under Surgery. Nobody from Anesthesia has approved them, although we ask their opinion before submitting any new changes**
6. Has AOH ever had an anesthesiologist? **Yes but over 10 years ago.**
7. Is the \$147/yr for malpractice insurance per CRNA (so really \$1470) or is it just a flat \$147 no matter how many you have? **This answer is pending. I have a call out to Croerys, our insurance cattier for clarification.**

Was the \$1200 paid twice in the last 2 years due to: 1: not enough cases so surgeries were cancelled or 2: no anesthesia providers available? I am just confused how it was written because at first I thought it was because no CRNAs could cover, but that doesn't make sense why you

would pay if they couldn't cover. So I am thinking it is because ortho didn't schedule the cases on time, correct? I don't want to assume anything and present any misleading data. **Per our CRNA contract they need to be notified of all cancelations within 7 days, otherwise we pay for their services, whether the patient is not medically cleared for the procedure at the last minute or the provider has an open day for procedures and has none scheduled.**



Appendix H: Comparison of Anesthesia and Surgical Departments*Incomplete and unknown information is highlighted yellow.*

	Aspirus Grand View	Aspirus Ontonagon	Aspirus Iron River
<i>Surgical Department</i>			
Number of ORs	3	1	2
Number of Endoscopy Rooms	1	0	1
Days ORs are Open (no Call)	5/week	4-5 days/month	5/week
Days ORs are Open (with Call)	7/week	None	7/week
Number of Days ORs are Open	253; Call coverage provided for other days	4-5 days/month	254; Call coverage provided for other days
OR Utilization	33%	56%	
Number of Surgeons	12	3	5
Surgical Specialties	General, endoscopy, ophthalmology, orthopedics, OB/Gynecology, ENT, and podiatry	Endoscopy, Orthopedic	General, Endoscopy, orthopedic, ENT, podiatric
Top Procedures Performed	General, endoscopy, Ophthalmology	As above	Flexible Endoscopy, General, Orthopedic, ENT, Podiatry
Anticipated Surgical Specialty Growth	Ophthalmology, possibly Urologist		Ophthalmology Urologist
Total number of Surgeries	2013-2014: 2,630 2014-2015: 2,484	2013-2014: 339	2012: 1,003 2013: 840 2014: 726 2015 (as of August): 446
Total number of Endoscopies in 2015	Included in totals above	Included in total above	Included in totals above
Average Length of Surgical Day in	5	7	6

Hours			
Time After Hours (Call) Begins for Surgical Staff	3:30 PM	N/A	3:30 PM
Nurse Minute to Surgical Minute Ratio (the number of nursing minutes required to support one surgical minute)	10.59:1	4.33:1	
Surgical Enuff Budget & Variance Report Available to Author	Yes (September 2015)	Yes (July 2015)	No
<i>Anesthesia Department</i>			
Costs with Credentialing (Permanent and Locum Providers)		\$50 initially, then \$45/CRNA every 2 years	
Strengths of the Department per Key Contact		"Fantastic crew and willing to work with all of us at AOH."	"Both do well in emergencies, with general anesthesia, and moderate sedation."
Weaknesses of the Department per Key Contact		"I would like to see CRNA's on EPIC for documenting and Billing purposes."	"Need more Regional Anesthesia choices."
Areas for Improvement per Key Contact			"Regional Anesthesia"
Has the Anesthesia Department been Over Budget in the Last 2 Years?	Yes, due to locum coverage	No	
Hospital Subsidization to the Anesthesia Department			
Frequency of Anesthesia Department Meetings	Yes, quarterly and as needed	None	Quarterly at Surgery Committee Meetings
Anesthesia Enuff Budget & Variance Report Available to Author	Yes (September 2015)	Yes (July 2015)	Yes (June 2015)
<i>Permanent Anesthesia Providers</i>			
Number of Anesthesiologists	0	0	1
Number of CRNAs	4	Locum CRNAs	1

		Only	
Medically or Non-medically Directed CRNAs	Non-medically directed	Non-medically directed	Non-medically directed
Are anesthesia providers hospital employed (W2) or Contracted (1099)	W2	1099 (locum CRNAs only)	1099
Weeks of Vacation	5/CRNA	N/A	N/A
Compensation for Anesthesia Providers	Salaried	Salaried	Salaried
Other Benefits of Permanent Staff	Annual CME money, full benefits	N/A	N/A
Is Call Pay Provided	Yes, after 3:00 PM	Never	No, included in salaries of permanent staff
Anesthesia coverage to other areas of the hospital	OB, ICU, ER, Radiology, Med-Surg	None	ICU, ER, Med-Surg
Obstetrics Coverage	Yes	No	No
Pain Services Provided	No	No	No
Regional Anesthesia Skills	Spinals, Epidurals Peripheral Nerve Blocks as needed for Orthopedic Cases	Peripheral Nerve Blocks, as needed for Orthopedic Cases	CRNA: Spinals Both: Bier Block No other Peripheral Nerve Blocks
Oversight of the Anesthesia Department	Director: Chief of Surgery, Chief CRNA oversees policies, procedures, scheduling	Locum CRNA Chris Yonker assists with scheduling providers, rarely consulted for policies and procedures	Anesthesiologist, oversees policies and procedures
Number of Anesthesia Hours Worked Per Year for Last 2 Years		2013: 368 2014: 264 First 6 months of 2015: 136	
Anesthesia call coverage	Yes, rotating with Providers' preference	No	Yes, generally 1 to 2 weeks in a row



Average Number of Daily Hours Anesthesia Providers Work	6	6	5 - 6
Time After Hours (Call) Begins	3:00 PM		3:30 PM
Frequency of Permanent Positions Filled in the Last 2 Years	2	N/A	None
Reasons for Vacancy of Permanent Position	1 – Provider was terminated 2 – New position	N/A	N/A
Problems with Recruitment	Geography	N/A	N/A
Malpractice Insurance on Permanent Provider	Yes: \$1 million per occurrence & \$3 million for all occurrences in 1 policy year	N/A	
Cost to Provide Malpractice Insurance on Permanent Provider		N/A	
<i>Locum Anesthesia Providers</i>			
Number of Locum Anesthesia Providers available	10	10	1
Number of Locum Anesthesia Provider Contracts		2	1
How Locum Anesthesia Providers are Found	Personal Contact; Agencies		Personal Contact
Frequency of Hiring an Agency Locum Provider (with Agency Fee)	Occasionally	Never	Never
Timeframe for Locum Anesthesia Provider to be Cancelled and Rate		7 days notice otherwise \$1,200	Once scheduled, \$1,100 even if cancelled
Frequency of Cancelling a Locum	Rare	Twice in past 2 years; \$1,200 was paid for not cancelling within timeframe	Once in past 3 years
Reasons for Locum Cancellation	Surgical department low census	Orthopedic cases not scheduled in timely manner to plan for staffing	Case cancellations
Frequency of Locum Anesthesia Providers not able to Cover Hospital	Occasionally	Twice in past 2 years	Never

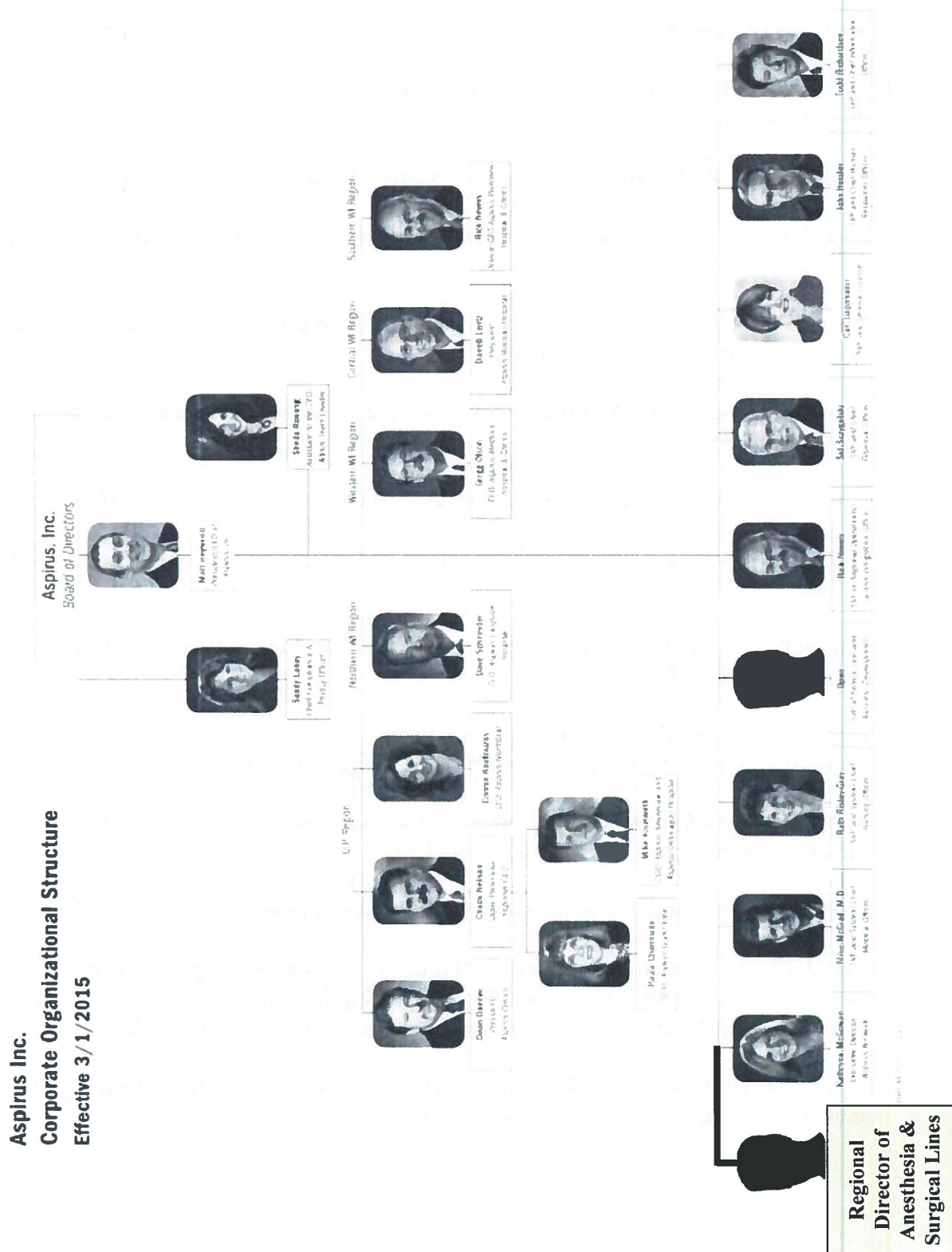


Actions Surgery takes when Locum Provider is not Available	Reschedule cases, stagger surgeon start times		
Minimum Daily Cost of Locum Anesthesia Providers	\$125/hour	\$1,100	\$1,100
Maximum Daily Cost of Locum Anesthesia Providers	\$150/hour	\$1,200	
Guaranteed Eight-Hour Day	Yes	Yes	Yes
Mileage for Locum Providers	Standard IRS rate	\$0.575/mile Average is \$100 to \$115/day	
Other Locum Provider Benefits	Housing for extended travel; meals at \$35/day	Housing for extended travel	
After hour Call Requirement for Locum	Yes, when permanent staff unable	No, unless case runs late or occasional add-on	Yes
Call Pay for Locum	\$225/hour; minimum 2 hour guarantee	N/A	Increased daily rate
Amount of Call Pay Paid to Locums in Last 2 Years		N/A	7 to 10 days
Malpractice Insurance on Locum Provider	Yes: \$1 million per occurrence & \$3 million for all occurrences in 1 policy year	Yes: \$1 million per occurrence & \$3 million for all occurrences in 1 policy year	
Cost to Provide Malpractice Insurance on Locum Provider		\$147/year (unclear if this is per CRNA, or includes all 10 CRNAs)	
Decision Making whether to Hire a Locum Provider	Based on surgical caseload	Based on surgical caseload	Regular Staff make schedule with locums as needed
Author's access to Locum Provider Contracts to Review for this Project	No	Yes	No

<i>Anesthesia Supplies and Equipment</i>			
Pattern of Re-ordering Supplies	Purchasing Department orders supplies	Weekly inventory and order placed	Weekly inventory and order placed
Most Frequently Used Anesthesia Supplies	Medline Stylet, Adult Anesthesia Mask, Anesthesia Circuit, Endotracheal Tubes, Esophageal Temperature Probe, Glidescope Blades, Oral Airways, Eye Shields, Nasal Airways, Epidural Trays, Anesthesia Universal Sets, Spinal Trays, Soda Sorb	Stimuplex A Insulated Needle, Contiplex Tuphy Continuous Nerve Block, Soda Sorb, Nasal Filter Line, Microbore Extension Set, Laryngeal Mask Airways, Spinal Trays, Laryngoscope Blades, Oxygen Masks, Endotracheal Tubes	Breathing Circuits, Endotracheal Tubes, Oral Airways, Medications
Type of Anesthesia Machine	Drager Apollo	Narkomed	Narkomed
Anesthetic Gases	Desflurane, Sevoflurane	Isoflurane, Desflurane, Sevoflurane	Desflurane, Sevoflurane
Large Anesthesia-Related Purchases in the Next Year	None	None	Anesthesia Machines x2
<i>Anesthesia QI</i>			
Current System to Monitor Adverse Anesthesia Reactions	Health Care Safety Zone (HCSZ)	Data is entered into the Ongoing Professional Practice Evaluation (OPPE)	Form completed for each patient
Review of Adverse Anesthesia Reactions	HCSZ, review during anesthesia department meetings	Health Care Safety Zone (HCSZ), then added to OPPE	Surgery Committee Meeting
Frequency of Adverse Anesthesia	Quarterly at	Follow-up in the	Quarterly at the

Reactions Discussed Among Permanent Anesthesia Providers	anesthesia department meetings and as needed	HCSZ as needed; Follow-up with locum CRNAs as needed	Surgery Committee Meeting, and as needed
Other QI		Root Cause Analysis; Peer Review if needed	

with the Director of Anesthesia and Surgical Services Lines over RASN





### References

1. Heisler, J. Mission, Vision, and Values: Our Present and Our Future. PowerPoint Presentation. Wausau, WI. Presented May 21, 2015.
2. Kimsey DB. Lean Methodology in Health Care. *AORN Journal*. 2010;92:53-60.
3. Goldstein L. The new wave of hospital consolidation. *Healthcare Financial Management*. 2012;66(4):61.
4. Umbdenstock R. The future of hospitals in america. *Healthcare executive*. 2014;29(2):78.
5. Birk S. Quality cost efficiency: The new quality-cost imperative. *Healthcare Executive*. 2010;25(2):14.
6. Hogan PF, Seifert RF, Moore CS, Simonson BE. Cost effectiveness analysis of anesthesia providers. *Nursing economic*. 2010;28(3):159.
7. Cromwell J, Snyder K. Alternative cost-effective anesthesia care teams. *Nursing economic*. 2000;18(4):185.
8. Anonymous. Anesthesia shortage? depends on the area. *OR Manager*. 2010;26(7):19.
9. Fallacaro MD, Ruiz-Law T. Distribution of US anesthesia providers and services. *AANA J*. 2004;72(1):9.
10. Johnstone RE. Market costs of short-term physician and nurse anesthesia services. *J Clin Anesth*. 1994;6(2):129-132.
11. Dexter F, Wachtel RE. Scheduling for anesthesia at geographic locations remote from the operating room. *Current Opinion in Anaesthesiology*. 2014:1.
12. Morgan H. *How hospital leaders can bend the anesthesia cost curve*. Vol 68. Healthcare Financial Management Association; 2014:110.
13. Elliot RA. The economics of anaesthesia. *Eur J Anaesthesiol*. 2001;18(4):205-207.
14. Abouleish AE, Prough DS, Barker SJ, Whitten CW, Uchida T, Apfelbaum aJL. Organizational factors affect comparisons of the clinical productivity of academic anesthesiology departments. *Anesthesia & Analgesia*. 2003;96(3):802-812.
15. Abouleish AE, Prough DS, Whitten CW, et al. Comparing clinical productivity of anesthesiology groups. *Anesthesiology*. 2002;97(3):608-615.

16. Newell TL, Steinmetz-Malato LL, Van Dyke DL. Applying Toyota Production System Techniques for Medication Delivery: Improving Hospital Safety and Efficiency. *Journal for Healthcare Quality*. 2011;33:15-22.
17. Drotz E, Poksinska B, Linköpings universitet, Tekniska högskolan, Kvalitetsteknik, Institutionen för ekonomisk och industriell utveckling. Lean in healthcare from employees' perspectives. *Journal of health organization and management*. 2014;28:177-195.
18. Dexter F, Macario A, Traub RD. Statistical method using operating room information system data to determine anesthesiologist weekend call requirements. *AAANA J*. 2000;68(1):21.
19. Jones RL, Plantes K. Cost containment in anesthesiology: A survey of the association of anesthesia clinical directors. *J Clin Anesth*. 1994;6(5):409-410.
20. Valenzuela RC, Johnstone RE. Cost containment in anesthesiology: A survey of department activities. *J Clin Anesth*. 1997;9(2):93-96.
21. Cima RR, Brown MJ, Hebl JR, et al. Use of Lean and Six Sigma Methodology to Improve Operating Room Efficiency in a High-Volume Tertiary-Care Academic Medical Center. *Journal of the American College of Surgeons*. 2011;213:83-92.
22. Taylor DL. Perioperative Leadership: Managing Change With Insights, Priorities, and Tools. *AORN Journal*. 2014;100:8.
23. Knudson L. Using block scheduling to improve OR efficiency. *Association of Operating Room Nurses*. *AORN Journal*. 2013;98:C1,C7.
24. Davis E. Educating perioperative managers about materials and financial management. *AORN journal*. 2005;81:801.
25. Hunt PS. Speaking the Language of Finance. *AORN Journal*. 2001;73:774.
26. Friedman DM, Sokal SM, Chang Y, Berger DL. Increasing operating room efficiency through parallel processing. *Annals of surgery*. 2006;243:10-14.
27. Harders M, Malangoni MA, Weight S, Sidhu T. Improving operating room efficiency through process redesign. *Surgery*. 2006;140:509-516.
28. Sokal SM, Craft DL, Chang Y, Sandberg WS, Berger DL. Maximizing Operating Room and Recovery Room Capacity in an Era of Constrained Resources. *Archives of Surgery*. 2006;141:389-395.
29. Stahl JE, Sandberg WS, Daily B, et al. Reorganizing patient care and workflow in the operating room: a cost-effectiveness study. *Surgery*. 2006;139:717-728.

30. Heiser R. Using a Best-Practice Perioperative Governance Structure to Implement Better Block Scheduling. *AORN Journal*. 2013;97:125-131.
31. Wingerter AK, Ackerman J. The ABC's of Block Scheduling. *AORN Journal*. 2015;101:611-631.
32. Dexter F, Epstein RH. Calculating institutional support that benefits both the anesthesia group and hospital. *Anesth Analg*. 2008;106(2):544-553.
33. Galati MF. Financial aspects of providing anesthesia in nonoperating room locations. *Int Anesthesiol Clin*. 2009;47(2):93.
34. Tremper KK, Shanks A, Morris M. Five-year follow-up on the work force and finances of united states anesthesiology training programs: 2000 to 2005. *Anesth Analg*. 2007;104(4):863-868.
35. McIntosh C, Dexter F, Epstein RH. The impact of service-specific staffing, case scheduling, turnovers, and first-case starts on anesthesia group and operating room productivity: A tutorial using data from an australian hospital. *Anesth Analg*. 2006;103(6):1499-1516.
36. McIntosh CA, Macario A. Managing quality in an anesthesia department. *Current opinion in anaesthesiology*. 2009;22(2):223.
37. Abouleish AE, Dexter F, Epstein RH, Lubarsky DA, Whitten CW, Prough DS. Labor costs incurred by anesthesiology groups because of operating rooms not being allocated and cases not being scheduled to maximize operating room efficiency. *Anesthesia & Analgesia*. 2003;96(4):1109-1113.
38. Dexter F, Epstein RH, Marsh HM. A statistical analysis of weekday operating room anesthesia group staffing costs at nine independently managed surgical suites. *Anesthesia & Analgesia*. 2001;92(6):1493-1498.
39. Dexter F, Macario A, Cowen DS. Staffing and case scheduling for anesthesia in geographically dispersed locations outside of operating rooms. *Current opinion in anaesthesiology*. 2006;19(4):453-458.
40. Dexter F, Epstein RH, Traub RD, Xiao Y. Making management decisions on the day of surgery based on operating room efficiency and patient waiting times. *Anesthesiology*. 2004;101(6):1444-1453.
41. Dexter F, Traub RD. How to schedule elective surgical cases into specific operating rooms to maximize the efficiency of use of operating room time. *Anesth Analg*. 2002;94(4):933-942.
42. Krafcik JF. Triumph of The Lean Production System. *Sloan Manage Rev*. 1988;30:41.

43. Calderone C. Lessons from Toyota. Home Care Magazine. Malibu: Penton Media, Inc., Penton Business Media, Inc. and their subsidiaries; 2007;30:16.
44. Collins KF, Muthusamy SK. Applying the Toyota Production System to a Healthcare Organization: A Case Study on a Rural Community Healthcare Provider. The Quality Management Journal. 2007;14:41.
45. Mannon M. Lean healthcare and quality management: the experience of ThedaCare. Quality management journal. 2014;21:7-10.
46. Womack JP, Massachusetts Institute of Technology. *The Machine that Changed the World: Based on the Massachusetts Institute of Technology 5-Million Dollar 5-Year Study on the Future of the Automobile*. New York: Rawson Associates; 1990.
47. Klann S. Borrowing from Toyota to improve quality. OR Manager. 2002;18:18.
48. Treville Sd, Antonakis J. Could lean production job design be intrinsically motivating? Contextual, configurational, and levels-of-analysis issues. J Oper Manage. 2006;24:99-123.
49. Liker JK, ebrary I. The Toyota way: 14 management principles from the world's greatest manufacturer. New York: McGraw-Hill; 2004.
50. Sugimori Y, Kusunoki K, Cho F, Uchikawa S. Toyota production system and Kanban system Materialization of just-in-time and respect-for-human system. Int J Prod Res. 1977;15:553-564.
51. Aherne J. Think lean. Nursing management (Harrow, London, England : 1994). 2007;13:13.
52. Ballé M, Régnier A. Lean as a learning system in a hospital ward. Leadership in Health Services. 2007;20:33-41.
53. Furman C, Caplan R. Applying the Toyota Production System: using a patient safety alert system to reduce error. Joint Commission journal on quality and patient safety / Joint Commission Resources. 2007;33:376.
54. Millard WB. If Toyota Ran the ED. Ann Emerg Med. 2011;57:A13-A17.
55. Stansfield T, Manuel J. It's time to take the Toyota Production System into operating rooms. Industrial Engineer. Institute of Industrial Engineers, Inc. (IIE); 2009;41:28.
56. Brandao de Souza L. Trends and approaches in lean healthcare. Leadership in Health Services. 2009;22:121-139.
57. Spear SJ. Fixing health care from the inside, today. Harvard business review. United States: Harvard Business School Press; 2005;83:78.



58. Stanton C. Management Connections: Using Lean to build high performing teams. *AORN Journal*. 2011;94:C7,C10-C7,C10.
59. Culig MH, Kunkle RF, Frndak DC, Grunden N, Maher TD, Magovern GJ. Improving Patient Care in Cardiac Surgery Using Toyota Production System Based Methodology. *Ann Thorac Surg*. 2011;91:394-399.
60. Womack JP, Jones DT. Lean Thinking-Banish Waste and Create Wealth in your Corporation. *J Oper Res Soc*. 1997;48:1148-1148.
61. Tucker AL, Edmondson AC. Why Hospitals Don't Learn from Failures: Organizational and Psychological Dynamics that Inhibit System Change. *Calif Manage Rev*. 2003;45:55-72.
62. Mann D, Books24x7 I. Creating a Lean Culture: Tools to Sustain Lean Conversions. New York, NY: CRC Press; 2005.
63. Davis BM. Applying Lean to the Perioperative Environment. *AORN Journal*. 2010;92:S100-S104.
64. Fillingham D. Can lean save lives? Leadership in Health Services. 2007;20:231-241.
65. Mason SE, Nicolay CR, Darzi A. The use of Lean and Six Sigma methodologies in surgery: a systematic review. *The surgeon : journal of the Royal Colleges of Surgeons of Edinburgh and Ireland*. 2015;13:91-100.
66. Waldhausen JHT, Avansino JR, Libby A, Sawin RS. Application of lean methods improves surgical clinic experience. *Journal of Pediatric Surgery*. 2010;45:1420-1425.
67. Siddique K, el-abyed S, Basu S. One-stop cholecystectomy clinic: A way forward for the future? *International Journal of Surgery*. 2012;10:S94.
68. Adams R, Warner P, Hubbard B, Goulding T. Decreasing Turnaround Time Between General Surgery Cases: A Six Sigma Initiative. *JONA: The Journal of Nursing Administration*. 2004;34:140-148.
69. Collar RM, Shuman AG, Feiner S, et al. Lean management in academic surgery. *Journal of the American College of Surgeons*. 2012;214:928.
70. Schwarz P, Pannes KD, Nathan M, et al. Lean processes for optimizing OR capacity utilization: prospective analysis before and after implementation of value stream mapping (VSM). *Langenbeck's Archives of Surgery*. 2011;396:1047-1053.
71. Burkitt KH, Mor MK, Jain R, et al. Toyota production system quality improvement initiative improves perioperative antibiotic therapy. *The American journal of managed care*. 2009;15:633.

72. Iannettoni MD, Lynch WR, Parekh KR, McLaughlin KA. Kaizen Method for Esophagectomy Patients: Improved Quality Control, Outcomes, and Decreased Costs. *The Annals of Thoracic Surgery*. 2011;91:1011-1018.
73. Parker BM, Henderson JM, Vitagliano S, et al. Six sigma methodology can be used to improve adherence for antibiotic prophylaxis in patients undergoing noncardiac surgery. *Anesthesia and analgesia*. 2007;104:140-146.
74. Sedlack JD. The utilization of six sigma and statistical process control techniques in surgical quality improvement. *Journal for healthcare quality : official publication of the National Association for Healthcare Quality*. 2010;32:18.
75. Kasivisvanathan R, Chekairi A. The productive operating theatre and lean thinking systems. *Journal of perioperative practice*. 2014;24:245.
76. Chung F, Yuan H, Yin L, Vairavanathan S, Wong DT. Elimination of preoperative testing in ambulatory surgery. *Anesthesia and analgesia*. 2009;108:467-475.
77. Wainwright T, Middleton R. An orthopaedic enhanced recovery pathway. *Current Anaesthesia & Critical Care*. 2010;21:114-120.
78. Hines P. Staying Lean: Thriving, Not just Surviving. 2nd ed. GB: CRC Press Inc; 2011.
79. Montanaro T, Pelczynski J, Strasser C. Strategies for improving supply chain management in perioperative services. *Healthcare Purchasing News*. 2005;29:45.
80. Hospitals. Aspirus. Accessed April 1, 2016, from <http://www.aspirus.org/Main/Hospitals.aspx?srcaud=Main>.
81. Stats and facts. Upper Peninsula Economic Development Alliance Web site. <http://upeda.com>. Updated 2010. Accessed June 8, 2015.
82. Estimated population by county: 2010-2011. Michigan Department of Technology, Management, and Budget Web site. <http://www.michigan.gov/cgi/0,4548,7-158-54534-297027--,00.html>. Updated 2015. Accessed June 2, 2015.
83. Estimated population change in michigan counties: 2011-2012. Michigan.gov Web site. [http://www.michigan.gov/documents/cgi/cgi\\_census\\_popch1112\\_414153\\_7.pdf](http://www.michigan.gov/documents/cgi/cgi_census_popch1112_414153_7.pdf). Updated 2012. Accessed June 5, 2015.
84. Network Map. Upper Peninsula Health Care Solutions. Accessed April 1, 2016, from <http://www.uphcn.org/uphcn/uphcnm.html>.
85. Quality and Costs. ThedaCare website <https://www.thedacare.org/Why-Thedacare/Cost-and-Quality.aspx>. Accessed January 15, 2016.

86. Faircloth AC, Ford MB. Implementing a perpetual anesthesia setup standardized for the trauma room in a level I trauma center. *AANA J*. 2013;81(1):43.
87. Rozich JD, Howard RJ, Justeson JM, Macken PD, Lindsay ME, Resar RK. Standardization as a mechanism to improve safety in health care. *Joint Commission journal on quality and safety*. 2004;30(1):5.
88. Kohn LT, Corrigan J, Donaldson MS, NetLibrary I. To err is human: Building a safer health system. 2000.
89. Shultz J, Davies JM, Caird J, Chisholm S, Ruggles K, Puls R. Standardizing anesthesia medication drawers using human factors and quality assurance methods. *Canadian journal of anaesthesia = Journal canadien d'anesthésie*. 2010;57(5):490-499.
90. Timmermans S, Berg M. The gold standard: The challenge of evidence-based medicine and standardization in health care, Temple University Press, Philadelphia, PA.
91. Brand Image. Business Dictionary website  
<http://www.businessdictionary.com/definition/brand-image.html>. Accessed February 22, 2016.
92. Brand Image. Management Study Guide website  
<http://www.managementstudyguide.com/brand-image.htm>. Accessed February 22, 2016.
93. Simon RW, Canacari EG. A Practical Guide to Applying Lean Tools and Management Principles to Health Care Improvement Projects. *AORN Journal*. 2012;95:85-103.
94. Leslie M, Hagood C, Royer A, Reece CP, Jr, Maloney S. Using lean methods to improve OR turnover times. *AORN Journal*. 2006;84:849.